THE AMERICAN

JOURNAL OF PHARMACY.

JANUARY, 1887.

ON THE USE OF MAYER'S REAGENT IN THE ESTIMATION OF ALKALOIDS.

By A. B. Lyons, M. D.

Experimental researches, the details of which were published in the December number of the Journal, justified the following general conclusions:

1. Results of titrations with Mayer's reagent are influenced by various conditions to such an extent that their indications have at best only an approximate value.

2. In dilute solutions the results of titration are always high, not low. Either a stated correction must be made, or a second experiment carried out in which the solution is brought to a standard strength, say of 1:200 or 1:300.

3. The influence of alcohol and of iodides (the same is true to a certain extent also of bromides and chlorides) is to interfere with the precipitation, and yet the effect of their presence may be beneficial rather than otherwise, the end of the reaction being more sharply defined with them than without. This is especially true where a modified reagent is employed, containing an excess of potassium iodide. Such a reagent gives more uniform results with certain alkaloids than the usual solution, but with many alkaloids is not to be preferred, and is not to be recommended for general use.

The object of the present paper is to record some further observations bearing on the question, how Mayer's solution may be most advantageously employed. That it is capable of yielding useful practical results is conceded even by those who criticise it most unsparingly.

The mode of conducting a titration must have an important influence on the result. Some direct to allow the precipitate to subside after each addition of reagent, and test a drop of the clear supernatant fluid with a drop of the reagent. A more common practice, and that which I have adopted in most of my experiments, is to filter the fluid after each successive addition of reagent, using the same filter, which must be only large enough conveniently to hold the whole of the fluid. The titration is concluded when the addition to the filtered fluid—having a volume of 10 cc.—of two drops of reagent fails to produce a permanent turbidity. In some cases the reagent as it drops into the fluid produces a transient turbidity, clearing up at once, while addition of a larger quantity of the reagent produces a permanent precipitate. The formation of this precipitate being obviously conditioned by the presence of a large excess of reagent, it is proper to ignore it.

No doubt the results of a titration will coincide more nearly with what theory requires if a considerable length of time is allowed to elapse after each addition of reagent, but this manner of conducting the operation robs it of its single advantage—rapidity of execution—and is not to be recommended, since, after all, there will be considerable and often quite capricious departures from theoretical figures.

The method, however, of carrying out titrations with Mayer's reagent that has been recently recommended by Frank S. Hereth[1] secures the advantages of the plan just mentioned without extending the time actually consumed in the operation. The method is as follows: Knowing approximately the alkaloidal strength of the solution to be examined, provide half a dozen or more test tubes or vials, and into each measure 10 cc. of the solution. To the first add a quantity of reagent a little less than that likely to be required; to the second a somewhat larger quantity, and so on. Let the test tubes stand at least eight hours, then test a portion of the clear fluid from each with a drop of Mayer's reagent. The first one which fails to react obviously has received a quantity of reagent a little more than sufficient for the precipitation, and it will not be difficult to judge by the amount of cloudiness produced in it just what excess of reagent is present. Of course the value of the titration equivalent will have to be determined anew experimentally, if this method is to be adopted.

---

1 *Pharmaceutical Record*, July 1, 1886.

Hitherto Mayer's reagent has been employed almost exclusively in the volumetric method. May we not hope to find it more satisfactory to weigh the precipitates produced, and so ascertain the quantity of alkaloid present? That depends of course on the constancy of composition of the precipitates produced. In my experiments I have given attention to this point also. I find that most of the precipitates vary considerably in weight under varying conditions. The weight of the precipitate often increases materially if it is allowed to stand some hours before collecting.

I have tabulated below some of the results of these experiments. In most cases the precipitates were collected shortly after they were formed, on a pair of mutually counterpoised filters, washed slightly with water, pressed strongly between folds of blotting paper, dried at 100° C. and weighed. Some of the precipitates bear washing fairly well. Most of them begin to dissolve as soon as excess of Mayer's reagent is no longer present. If the washing is continued, a precipitate begins to form in the washings, showing that the water is carrying through some of the alkaloid, the precipitate being either decomposed or dissolved. By using moderately dilute solutions, however, and washing the filters rather than the precipitate, results were obtained which are believed to be reasonably near the truth.

The precipitates were analyzed in the following manner: They were dissolved in alcohol, ammonium sulphide was added in slight excess, and the mercuric sulphide was collected, dried and weighed. The solution was then treated with a drop or two of solution of ferric sulphate to precipitate the excess of sulphur, filtered, and the iodine estimated volumetrically with silver nitrate. In a few instances the silver iodide was also collected and weighed, the result generally coinciding with that obtained by titration, although in some cases it seemed probable from the discrepancy in weight that the precipitate contained chlorine as well as iodine.

It is expected that the color of the precipitate of mercuric sulphide will be black when an excess of reagent has been employed to produce it. In all but one of my experiments such was the fact; in the exceptional instance, the precipitate remained persistently red, a bright brick-red, like native cinnabar. Which of the alkaloids it was that gave this anomalous reaction, I cannot now remember, but there is a suggestion in the observation of a possible new method of preparing vermilion.

The following table gives the results of the experiments made with reference to the composition of the precipitate:

Name of alkaloid.	Weight of Prec. containing 100. alkaloid.[1]	Average weight of alkaloid in 100. of prec.[2] approx.	Weight of prec. analyzed.	Hg. in prec. analyzed.	Atoms Hg.	I. in prec. analyzed.	Atoms I.	Molecular weight of prec.[3]
Aconitine	179–188	54·8	182·5	27·5	0·73	55	2·35	954–1002
Atropine	216–245	54·4	220	51	0·73	69	1·6	624–708
Berberine	200[3]	56·0	. . . .	25[3]	0·42	75[3]	2·0	670[3]
Brucine	190–214	48·9	205	30	0·59	75	2·33	749–843
Cinchonidine	348–370	28·5	352	60[3]	0·92	192	4·65	1072–1160
Cinchonine	324–348	30·0	339	62·5	0·96	176·5	4·28	988–1072
Cocaine	240–270	40·7	246	50	0·76	94	2·25	. . . . .
Colchicine	155–180	. . . .	159	34	0·58	25?	?[4]	491–571
Emetine	240–256	40·8	245	44	1·09	105	4·10	1190–1270
Gelsemine	185–200	52·4	. . . .	50[3]	1·02	50[3]	1·61	816[3]
Hydrastine	200–210	47·6	210	37	0·73	73	2·28	834[3]
Hyoscyamine	222–250	43·5	228	46	0·66	82	1·87	642–7 3?
Morphine	190–204	48·6	202	42	0·60	60	1·35	541–5821
Pilocarpine	295–340	. . . .	308	81	0·84	127?	2·084	614–707
Quinine	310–335	30·8	325	64	1·04	161	4·11	1004–1085
Strychnine	258–274	37·9	264	57	0·95	107	2·81	880–913

What I desire to show by these tabulated results is that, making all allowance for such deviation from the normal composition as we may look for in complex compounds formed under such circumstances as those of my experiments, a few only of the precipitates appproximate a composition corresponding with the formulæ assigned them by Prof. Mayer. From the data here presented, it would appear that in the case of the cinchona alkaloids, emetine, gelsemine (?) and strychnine, the precipitate contains one atom of mercury for each alkaloidal molecular group. For the cinchona alkaloids and emetine, at least, the normal formula is probably $R''I_2,HgI_2$, R representing the alkaloidal radical. There is some uncertainty about the record I have of the single experiment made with gelsemine. If there is not some mistake in the recorded figures, the composition of the precipitate is quite anomalous, but the formula of gelsemine cannot be considered to be as yet positively fixed.[5]

[1] The higher figures in this column were generally obtained only when the precipitate was left some hours before filtering.

[2] Precipitate collected soon after it is formed.

[3] Assuming that it contains one equivalent of alkaloid.

[4] The precipitate seems to contain Cl as well as I.

[5] My associate in analytical work, Mr. F. A. Thompson, is making a new study of the alkaloids of gelsemium, which will shortly be published.

In general, it appears that the formulas must be less simple than is commonly represented, and they show a smaller proportion of both mercury and iodine than one should expect, unless we abandon the theory that the compounds are double iodides. [It will be remembered that ammonia is precipitated (in alkaline solutions only) as a compound of quite a different constitution, the formula of which is $Hg_4N_2I_2,2H_2O$.] In several instances the proportion of iodine is but little more than sufficient to satisfy the demands of the dyad mercury alone.

The question of vital consequence is whether precipitates produced by Mayer's reagent are of so constant a composition as to be available for purposes of gravimetric estimations. With a few exceptions, I believe that where approximate results only are contemplated, they are thus available. When they are to be used in this way, they must be produced by adding at once sufficient reagent to precipitate the alkaloid completely, with a small margin of excess. The precipitate must be allowed to stand several hours before it is collected. It will not bear much washing. Sometimes it will adhere firmly to the beaker. When this is the case it may be washed once or twice superficially with water, dried in the beaker and weighed. Otherwise it can be best collected on a pair of mutually counterpoised filters, washed with a little water, so applied as to wash the filters rather than the precipitate, pressed between folds of filter paper, dried at 100° C., and weighed. It is evident that a precipitate thrown down in a solution heavily loaded with foreign substances, such as that obtained from a fluid extract, cannot be advantageously used in this mode of estimation, since the precipitate would carry down mechanically too much foreign matter, which we cannot wash out without material loss of the substance of our precipitate. It is therefore advisable in such a case to separate the alkaloid, in a crude form at least, in the first instance, dissolve it in a little acid, make up to a suitable volume—the solution should not contain more than 1:200 of the alkaloid—and precipitate from this prepared solution.

Further experiments are necessary to ascertain exactly what, under the conditions here prescribed, will be the average weight of the precipitates produced.

The principal reason why the results of titrations made under varying conditions show such large differences, is that there is always required to complete the precipitation of the alkaloid a notable excess

of reagent. The quantity of mercury which combines with the alkaloid, although not perhaps absolutely constant, does not show any wide range of variation, particularly when the conditions of the precipitation are similar. Some simple mode of estimating the excess of reagent present at the end of the titration—or, better, after several hours have elapsed—is therefore obviously a desideratum. Prof. Mayer's plan of titrating the excess with decinormal silver nitrate—apart from other considerations—ignored the circumstance that the reagent contains an excess of iodine over and above what takes part in the reaction and that it also contains chlorine. Besides, the alkaloids requiring titration are not unfrequently in the form of chlorides. In order to obtain any useful results by Prof. Mayer's method, a complicated mathematical calculation is required, of which the data themselves cannot be assumed *a priori* to be known.

Observing that the precipitate produced by silver nitrate in a fluid containing Mayer's reagent was at first bright chrome yellow, while, on continued addition of the silver solution, the successive portions of precipitate passed from a bright to a pale yellow color, it occurred to me that it might be, after all, possible to estimate the excess of mercury by this means, assuming that the bright yellow compound is a double iodide containing mercury. It appears, however, that this compound is not formed exclusively at the beginning of the reaction, and the color fades so gradually that no exact conclusions could be drawn from the indications presented, although they serve as a rough measure of the amount of the excess.

Incidentally, I desire to call attention to the existence of the bright yellow compound in question which I regret that I have not had time to study. It is remarkable that it is not at all sensitive to light. Its composition and properties are worthy of investigation.

Finding that strychnine was precipitated more perfectly than almost any other alkaloid, and with less variation under different conditions, I thought it might be practicable to estimate the excess of reagent in a solution by the use of this alkaloid, and the plan is one that proves measurably successful. After finishing the titration in the ordinary way, add to the filtered fluid one, two or three cc. of a solution of strychnine of a strength corresponding exactly with that of the Mayer's reagent used. Filter and titrate the excess of strychnine with Mayer's reagent, and by deducting the quantity used of the latter from the amount of strychnine solution added, the required excess is obtained.

The practical objection to this procedure is that it requires the operator to provide a standard solution of strychnine,[1] which will take some extra time and labor to prepare, and which will, perhaps, change with time, necessitating frequent re-examination after it is prepared. For the pharmacist I certainly should not recommend the method, while the professional chemist will object that it is lacking in precision.

In my former experiments upon the pure alkaloids, I estimated excess by a very simple colorimetric method, as follows: I diluted 1 cc. of the Mayer's reagent N 1:20 to 200 cc. with distilled water, placed 10 cc. of the dilute fluid in a tube of white glass, added a small drop of ammonium sulphide, and then diluted portions of the filtered fluid in which I wished to estimate excess, until 10 cc. treated in a similar manner gave a fluid of the same shade of color, a pale golden brown. Suppose the whole volume of fluid at the close of the titration were 12 cc. A portion of this fluid, diluted with $4\frac{1}{2}$ times its volume of water, gives a color identical with that of my standard. Then, $12\times4\frac{1}{2}\div200=0.27$ will be the excess sought.

It will be seen at once that this plan is applicable only in titrations of colorless, or nearly colorless fluids. I have at present no further suggestion to offer in this direction, but there should be no difficulty in devising some simple plan for making this estimation of excess volumetrically.

The work I have done, it will be readily seen, is after all of a preliminary character. In some of it I have doubtless been anticipated by others, whose results I have not been fortunate enough to have met with. I trust, however, that on the foundation that is afforded by the body of observations to which these hereinbefore recorded are a contribution, there will ultimately be built structures of analytical methods that will be able to withstand all storms of adverse criticism.

DETROIT, MICH., Nov. 16, 1886.

Poisoning from sorrel.—A fatal case of poisoning is reported in *Hospital Gazette*, June 19, 1886. A boy five years of age ate a quantity of fresh sorrel, Rumex Acetosa, *Lin.*, and subsequently to quench the thirst drank of soapy water within his reach. The decomposition of the soap by the acid oxalate of the sorrel resulted in the production of a freely soluble salt by the absorption of which the fatal event was hastened.

---

[1] The strychnine solution, to correspond with a reagent N 1-20 should contain in each cc about 8·5 mg. strychnine.

SYNTHETICAL OIL OF GAULTHERIA.

By Charles Bullock.

Read at the Pharmaceutical Meeting, December 21.

In 1842 William Procter, Jr., published in the American Journal of Pharmacy, "Observations on the volatile oil of Gaultheria procumbens"—proving it to be a hydracid similar to salicylic acid.[1]

Subsequently M. Cahours made an ultimate analysis of the oil and showed that it had the same composition as salicylate of methylene.

There has now been introduced into commerce a synthetical oil of gaultheria. This oil is colorless, has a specific gravity of 1·176 and boils at 398° F.

The odor of the oil closely resembles that obtained from the plant; when agitated with water the same reaction is afforded on addition of chloride of iron as is given by the natural oil. It may be distinguished from the natural oil by agitating a few drops with water in a tube, a tinted mixture is formed from which the oil does not separate for some time; the oil from the plant when agitated with water separates almost immediately in clear drops. The artificial oil contains a small amount of what appears to be methyl ether, which tends to suspend the oil in water; repeated washing removes most of this product, after which the oil settles more quickly.

Some experiments were made by Mr. Geo. M. Berringer on the manufacture of the oil, using the following formula:

Salicylic acid, ½ oz.
Methylic alcohol, absolute, 2 fl oz.
Sulphuric acid, 1 fl oz.

Dissolve the salicylic acid in the alcohol, then add gradually the sulphuric acid; warm gently during 24 hours; then distill from a retort into which a current of steam is introduced.

The distillate is to be well washed and separated by decantation. The odor of the product improves by keeping.

[1] Vol. xiv, p. 211.

Piper Betle, Lin.—The volatile oil of the leaves was found by Schmitz to be a good antiseptic and useful in catarrhal complaints. Dr. Kleinstück of Jena has obtained similar results. The volatile oil appears to contain an aldehyde, and is stated to rapidly oxidize on exposure and to loose its characteristic odor and its therapeutic properties.

SUBIODIDE OF BISMUTH.

By Joseph W. England, Ph. G.

Read at the Pharmaceutical Meeting, December 21.

Some ten years ago, Dr. A. Sidney Reynolds, of this city, through Mr. R. F. Fairthorne, a graduate of this College, introduced into hospital practice the use of bismuth subiodide (or more correctly, oxyiodide), in the local treatment of chronic ulcers, syphilitic sores, eruptions, etc., etc., and found it to be a most efficient remedial application, more effective than iodoform, with none of the "saffron-like and almost insuppressible odor," so characteristic of that latter antiseptic. It was employed to a limited extent, but its high cost militated effectually against its more general adoption.

Recently, Dr. Reynolds has published[1] the results of his experiments for the past ten years and expressed, most fully, the applicability of this chemical as a dressing and as a perfect substitute for iodoform, calomel, bismuth subnitrate and others in vogue. He claims that "it will control inflammation, allay irritation, suppress suppuration, promote granulation and induce cicatrization. It has been found to be almost a specific in gonorrhœa, in various septic and specific mucous inflammations, oral and nasal catarrhs, ophthalmias, etc., in chancroids, rectal ulcers, etc., and in the various cachectic and dyscrasic ulcerations. Internally, it is strongly recommended in gastric ulcers, gastritis and in typhoid fever."

It has been freely and extensively used in the venereal, surgical and other departments of the Philadelphia Hospital for the past two or three months, and Dr. E. Matlack, of the resident staff, thus expresses himself upon the results of his experience: "The subiodide of bismuth would seem, in internal medication, to be indicated in all those conditions for which the subnitrate of the same metal is at present employed, and locally, its action can best be compared to that of iodoform, possessing as it does, anæsthetic and sedative properties, but superior to that agent, in that it is not poisonous by absorption, it is free from all odor and it suffices, when a less quantity is used, to cover the same extent of surface." Experiments are now being made by Dr. E. O. Shakespeare, Curator of the pathological department of the same institution, touching its relative germicide value in comparison with that of iodoform and others, the results of which will be announced at a later date.

[1] The subiodide of bismuth in the treatment of ulcerations. *Med. News*, Oct. 9, 1886, p. 303.

It is a matter of interest, that the first general statement concerning this oxysalt was, probably, made by Messrs Woodman and Tidy,[1] who found it in an old mixture of potassium iodide and bismuth subnitrate given, by them, to one of the patients of the London Hospital. They stated that the change took place slowly, with the formation of the soluble potassium nitrate and the insoluble bismuth iodide. This iodide, they isolated, was a fine, brick-red powder, consisting of very small, cubical crystals, almost insoluble, both in water and solution of potassium iodide. Saturated solutions of chloride of ammonium, chloride of sodium, ferrocyanide of potassium and corrosive sublimate, failed to dissolve it in any appreciable quantity. Acetic acid dissolved it, slightly, without effervescence. On boiling it with a solution of potassium or ammonium hydrate, the hydrated oxide of bismuth was produced, which was insoluble in excess of either reagent. On treating the iodide with strong nitric acid, there was strong effervescence, fumes of iodine being given off, with a residue entirely soluble in alcohol and which, upon further examination, proved to be pure iodine. Acid solution of bismuth nitrate remained, which was not precipitated by a small quantity of water or until neutralized. With hydrochloric or sulphuric acid, there was no effervescence, but iodine was again precipitated, and, with the sulphuric acid, some iodic acid was formed. Oxalic acid also decomposed the salt, setting free the iodine; the action being somewhat slower than it was in the case of the mineral acids. A few trials of it, internally, in doses of from 5 to 20 grains, appeared to indicate that it was not an energetic therapeutic agent; which apparent lack of activity was ascribed to its comparative insolubility.

As previously stated, the high cost of this bismuth dressing ($12 a pound), has effectually prohibited its general employment and the writer was led to make a series of experiments, in the Philadelphia Hospital, concerning its mode of preparation, in order to ascertain whether some method could not be devised, whereby the compound could be much more readily and cheaply made.

The general method, as stated to be at present employed, *i. e.*, solution of bismuth subnitrate in sufficient strong nitric or hydrochloric acid, and precipitation in, or with, potassium iodide solution, is very unsatisfactory in practice, in that the precipitates formed, are of very

[1] *British Med. Jour., vide* AMER. JOUR. PHARM., Feb., 1871. p. 85.

varying chemical composition, if any of the details of preparation are deviated from in the slightest degree.

In the first place, if the acid solution of the bismuth salt is too acid and the potassium iodide solution is too strong, iodine is liberated and the product is black, probably, from the formation of the black triodide (BiI_3) of Messrs. Fletcher and Cooper.[1] Then, if the acid solution is too weak or the added potassium iodide is too dilute, the great tendency is toward the formation of a large proportion of oxynitrate. Then, if to the strongly acid solution the iodide, in not sufficiently diluted solution, is added the precipitate will be very deep reddish-brown in color, which apparently does not change on standing in cold water, and the variability of whose hue seems, partially at least, to depend upon the acidity of the acid solution and upon the temperature at which the liquids are mixed. Lastly, if the acid solution is made with the correct degree of acidity and is poured into mixed solution of potassium iodide and sodium acetate, the so-called yellow iodide of bismuth is formed; a precipitate whose color varies in shade as obtained by different methods, and whose contained iodine, in quantity, is in direct proportion to the depth of its color. This latter product has been proved[1] to be nothing more than a very basic compound of five molecules of bismuthous oxide (Bi_2O_3) and one molecule of bismuth iodide (BiI_3).

The extreme variability of the products sold as pure bismuth subiodide may be inferred from the fact, that of the several makes which have appeared in the markets, one was of a light-buff yellow color, apparently made as previously mentioned or by trituration, simply, of the oxynitrate with a solution of potassium iodide. Another was very light reddish-yellow in color, evidently made by trituration of the oxynitrate with Lugol's solution of iodine, and consisting of a slightly larger percentage of oxyiodide than the former; and, yet another sample was of the normal brick-red color characterizing the true product.

The first process devised by the author was used for nearly two months, and was based upon the fact that bismuth subnitrate was first decomposed, partially, when triturated with potassium iodide, in aqueous solution, to form small quantities of iodide and oxide of bismuth, then by nascent iodine (in the presence of hot water), liberated through

[1] Year-book of Pharmacy, 1882, p. 472–479.

the gradual addition of dilute nitric acid (U. S. P., '80) all the bismuth salts were converted, first, into the black iodide, and then by the hot water present into the red oxyiodide. If great purity is desired, the addition of hot water could be omitted and the suggestion of Prof. Maisch [1] be employed, namely: that to obtain the oxyiodide pure, the unwashed, dried, precipitated brown (black?) iodide should be dissolved in hydriodic acid or in potassium iodide and precipitated with water. He further stated that the black bismuth iodide can be made by subliming a mixture of iodine and powdered bismuth, whereby black metallic scales of the iodide are obtained, which are permanent in the air, but little affected by cold water and quickly converted by hot water into the red oxyiodide. It may be here mentioned, in connection with the "trituration process," previously described, that the addition of the dilute acid should not be pushed beyond the point where all the bismuth salts are decomposed, because the product becomes darker than its normal color, with the setting free of iodine and the formation of varying quantities of black triodide, which latter, however, may easily be rechanged to the oxyiodide by treatment of the precipitate with water. The whole reaction, accepting the U. S. P. (1880) formula for bismuth subnitrate, may be summed up as follows:

$$\underset{306}{BiON_3H_2O} + \underset{165.6}{KIO} = \underset{352.6}{BiOI} + \underset{101}{KNO_3} + \underset{18}{H_2O}$$

The following is the formula employed, using four times the molecular weight in grains:

Take of

Bismuth subnitrate,	℥ iiss, gr. xxiv.
Water (hot),	f℥ viii.
Potassium iodide,	℥ xi. gr. iii
Dilute Nitric acid, q. s. or about	f℥ vi.

Triturate, in a mortar, the bismuth compound, with the potassium iodide dissolved in the hot water, and then slowly add, with constant trituration, f℥iv of the dilute acid, and the remainder, drop by drop, until the decomposition is complete. Filter; wash the precipitate thoroughly with warm water until the washings cease to affect blue litmus-paper; dry, and powder. The yield is about three troy ounces, whose cost, counting the ingredients of manufacture at market rates, is inside of $3.50 a pound (av.) or 25 cents an ounce (av.), instead of $12 a pound (av.) or 75 cents an ounce (av.).

---

[1] Amer. Jour. Pharm. December, 1886, p. 599.—Bismuth Oxyiodide.

Concerning the present chemical formula given to subnitrate of bismuth by our present pharmacopœial standard (U. S. P. 1880), there is much to be said in criticism upon it. The Pharm. Germ.[1] says of this bismuth salt, that "when heated to 120°C. (248°F.) it loses between 3 and 5 per cent. of moisture, and at a red heat gives off yellowish-red vapors, and leaves between 79 and 82 per cent. of bismuthous oxide."

In confirmation of this view, Mr. S. E. Wolf[2] has made a series of quantitative experiments, as follows, (using 30 gm. of bismuth subnitrate, dissolved in 30 cc. of nitric acid, with the aid of heat, and diluting with sufficient distilled water to make 150 cc.); 10 cc. of the solution were precipitated, first with 50 cc. cold water, secondly with 50 cc. boiling water, and, thirdly, with 500 cc. cold water; the precipitates were dried in an air-bath, weighed, then ignited and again weighed. A sample of bismuth subnitrate (iv.), prepared strictly in accordance with the U. S. P. (1870), formula was examined, in like manner. The results are as follows:

	I.	II.	III.	IV.
Weight of precip.,	1·0 gm.	1·05 gm.	·396 gm.	1·0 gm.
Weight of oxide,	·753 gm.	·855 gm.	·329 gm.	·865 gm.
Percentage of oxide,	·753	81·4	83·3	86·5

In corroboration of these statements we have just given, in this month's JOURNAL,[3] the results of Mr. S. L. Rambo, who found, in drying four samples of the commercial salt, at 120°C., that the loss in weight, from the evaporation of moisture, varied between 2·0 and 3·42 per cent., and the oxide, resulting from ignition, weighed 79·2, 79·8, 80·2 and 80·25 per cent.; results agreeing fairly with those above.

Now the formula $BiO\,NO_3$ indicates 81·2 per cent. Bi_2O_3, and the formula $BiO\,NO_3.H_2O$, (U. S. P. '80) equals 76·47 per cent. oxide, whereas the general results of Messrs. Wolf and Rambo plainly point to the first formula, and from these data it may safely be concluded that the varying quantities of moisture contained in commercial bismuth subnitrate is dependent, first, upon the relative quantity of water used to precipitate the oxysalt, and, secondly, upon the relative degree and duration of heat, with which the oxysalt is dried, and, that the contained water from its variations in quantities is not water of

[1] P. G. *vide* Nat. Dispensatory, 3d Edt., p. 322.
[2] AMER. JOUR. PHARM., Dec., 1882, p. 593–595.
[3] Bis. Sub. Nit. AMER. JOUR. PHARM., Dec., 1886, p. 592.

crystallization, but merely adhering moisture readily dissipated by proper drying, and hence cannot be considered as existing in the state of chemical combination, any more than, for example, water contained in improperly-dried washed sulphur.

Returning to the consideration of the oxyiodide prepared by the process given above we find the precipitate to be a fine brick-red powder, odorless, very slightly astringent in taste, showing extremely minute cubical crystals, averaging about the 1-32 of an inch in diameter when magnified 900 diameters; insoluble in alcohol, ether or chloroform, and evincing the general properties of the compound of Messrs. Woodman and Tidy. Now, as before mentioned, the chemical character of this product depends directly upon the quantity of acid used to decompose the potassium salt. If too much acid has been used, the filtrate becomes red and tinges gelatinized starch blue, and black iodide is formed, resolvable by treatment with boiling water into the red oxyiodide.

There is an objection to the acceptance of this "trituration process," as a general one, while it is extremely simple, in that it requires an uncertain quantity of dilute nitric acid, a very careful manipulation, and a nice discrimination as to the exact point when the decomposition is complete. Hence it would, probably, be considered only as a tentative process, open for improvement. Subsequently, the author succeeded in devising a satisfactory modification of the existing precipitation method, which would be more practicable, in general employment, and more capable of yielding a constant product than that one. The following is the formula:

Take of

Bismuth subnitrate,	℥ iiss, gr. xxiv.
Acid nitric,	f℥ iii.
Hot water,	f℥ xii.
Potassium iodide,	℥ xi, gr. iii.
Hot water,	f℥ xxviii.

Dissolve the bismuth salt in the acid in a porcelain capsule with the aid of heat and add 12 fluidounces of boiling water in small portions at a time, stirring after each addition. Then pour the bismuth solution in the hot water, in which has been dissolved the iodide, agitating it well after each addition. Continue agitating until decomposition is complete. Filter at once. Wash the precipitate with warm water, dry and powder.

Boiling, or nearly boiling water, is used to dilute the strong acid

solution, because it will, thereby, be able to stand more dilution without precipitation of oxysalt than with cold water. The black triodide is first formed, which, on agitating the warm liquid for several minutes, gradually changes into the red oxyiodide. The bismuth solution is poured into the iodide, and not the reverse, in order to prevent the formation of oxynitrate. Hot water is used to precipitate the bismuth salt in, because it greatly facilitates and hastens the conversion of the black iodide into the red oxysalt. Yet, at the same time, care must be exercised that the liquid be not too hot when added together, otherwise the strong nitric acid will cause the decomposition of a portion of the oxyiodide with the formation of iodine fumes and the consequent weakening of the product in the amount of its combined iodine. The chemical reactions in the making and the properties of the finished product, are identical with those of the "trituration process." The yield is about the same.

Samples of the several products, as obtained in the course of experiments, are here presented for your inspection and criticism. No. 1 is impure black triodide, made by triturating bismuth subnitrate with strong potassium iodide solution, adding strong hydrochloric acid and filtering, without washing, and drying. It is of a deep bluish-black color, which assumes a much lighter shade, when long triturated with cold water, from the gradual formation of a portion of oxysalt, and speedily changes into the red oxyiodide if triturated with boiling water. No. 2 is the so-called yellow iodide, made with bismuth subnitrate and potassium iodide in the presence of cold water. No. 3 is the same as No. 2, only made by boiling the two salts together, in water. No. 4 is the subiodide, so-called, made with Lugol's solution of iodine. No. 5 is pure subiodide purchased. No. 6 is pure subiodide made by trituration, in accordance with the first process. No. 7 was made by precipitation, in compliance with the second formula; and No. 8 was made by the formula of Mr. Mayo, given in AMER. JOURN. OF PHARM., December, 1886, p. 590. It contains considerable oxychloride as impurity.

Poisoning by Squill.—Several fatal cases of poisoning by squill are reported by Dr. E. B. Truman, (*Lancet*, Sept. 4, 1886), who owing to the variable composition of squill, regards it as an unreliable and unsafe drug.

THE SULPHUR INDUSTRY OF THE WEST.

By Harry C. Myers.

Read at the Pharmaceutical Meeting, December 21.

The mineral deposits of our great West have for many years attracted a great deal of attention, both in this country and abroad. Besides the common minerals and compounds that chemists acknowledge as existing, there are beds of pure, white kaolin, mineral wax or ozocerite, borax, petroleum, bituminous coal veins forty feet thick, rich sulphur deposits, etc. The subject to which this article is confined is sulphur. Sulphur, I believe, is not recognized by text-books as existing to any extent in this country, and yet, in the Territory of Utah, there is, beyond doubt, the richest and largest known sulphur deposit in the world.

Sulphur is of volcanic origin, and existed in the interior of the earth; being heated there it escaped in the form of vapor, and was precipitated on coming in contact with the cold air. In order to refine this sulphur it is but necessary to repeat the process of nature by vaporizing and condensing.

It would seem by the extent and purity of *this* deposit, however, that at some remote period the sulphur must have poured out in a molten mass and flowed like lava into the valley beneath. This enormous deposit was located in about 1870, by the Government Surveyor, and is situated two hundred miles south of Salt Lake City, between the counties of Millard and Beaver on Cove Creek.

The deposit is about two thousand feet square, and shafts have been sunk in different places from thirty to sixty feet deep without reaching the bottom of the deposit; the depth is as yet unknown. It is easy to see by useing these figures and multiplying by the weight of a cubic foot of sulphur, which is over a hundred pounds, that this deposit contains easily ten million tons of sulphur. The poorest ore yet found in this locality contains 40 per cent. sulphur, and is almost black in color; but as the 90 per cent. ore is inexhaustible the poorer ores are disregarded. These ores were analyzed at Case School of Applied Science, by a familiar process, and found to be absolutely free from arsenic and antimony, which cannot be said of our imported Sicily sulphur. The sulphur in this deposit is in strata, measuring from eleven to twenty-two inches in thickness, and as it is a surface deposit it is worked much like the quarrying of stone. It is then refined by a new process,

which consists of melting the sulphur, forcing and straining it through a cylinder by the heat and pressure of steam, and as the ore is only contaminated with lava sand, it is very easily separated.

In many parts of this deposit the vapors are still rising and the deposition is continuous. In sinking shafts the vapors are so intense that several workmen are required, for one man is soon overcome and another one must take his place; and often, birds and small animals enter the sulphur pits for shelter and are soon overcome and suffocated. In 1872, a party of business men endeavored to find the extent of this deposit. On camping out the first night, their tents were filled with vapors and they were nearly suffocated; next day they started to sink a shaft, again the vapors drove them away and they had nothing to show for their trouble except a pair of sore eyes apiece. On their return they reported the discovery of the infernal regions in active operation. The way in which this deposit was discovered is a rather peculiar one: it was noticed that at a certain time in the year, when the foliage of the trees was just beginning to appear, that wherever a tree was growing near a sulphur deposit it was greener and more advanced than the trees about it; knowing this fact, a single person was enabled to discover and locate fourteen deposits. This advanced growth was probably due to the warmth of the rising vapors. Soon after the discovery of these beds, some English capitalists sent over experienced men at a great expense, who, being ignorant of this fact, failed to make a single location.

A few years ago sulphur was discovered in Mt. Humboldt, Nevada, which was 98 per cent. pure, but it proved to be only a "pocket" and was soon exhausted. Rich deposits were also discovered in New Mexico as well as in California and Colorado; in fact, at the Exposition at New Orleans, nearly all the western States reported sulphur deposits and exhibited specimens of the ore, but owing to lack of railroad facility, or extent of the ore these deposits have not been operated to any degree.

The high rates of freight in the West have been a great drawback to the mining industries, and have compelled us to borrow of our neighbors when we have abundance at home. This is the case with our sulphur industries. We now import nine-tenths of our sulphur from Sicily. The ore there is taken from the bed of an extinct crater, several hundred feet below the surface, and is carried to the surface upon the backs of children. The ore does not average above 20 per cent. It is then partially refined and shipped to us as "crude sulphur;" this is done to

avoid the duty on the refined article, and as it is shipped *free* as ballast, it makes a cheap article with which American high-priced labor and freights will hardly allow of competition.

The great demand for sulphur is, of course, for the manufacturing of sulphuric acid, and it would seem at first sight that it would be necessary to ship our western sulphur to the east and supply this demand, in order to make the enterprise a profitable one; this, plainly enough, would eat up the profits. But such is not the case, the demand for sulphur in the West is enormous and is steadily increasing, and will continue to increase as long as the population increases and new industries are started in operation. Sulphur is used largely in the West, especially in Colorado, New Mexico, and Texas, as a "sheep dip." This "dip" is composed of sulphur and an alkali, and is used for cleansing the sheep and destroying a kind of itch that is common in that locality. The carrying out of this cleansing is compelled by law. Little towns in the West that are hardly noticeable on the maps and are almost unheard-of, purchase annually from five to ten carloads of sulphur. This sulphur is then sold to the various ranches in the vicinity and used as described. Sulphur, again, is largely used in restoring old vineyards, especially in California and that vicinity. It is also used in a variety of smaller ways that are well known in the East. The imports of this article in 1878 were 48,102 tons, and in 1886 were 117,538 tons, showing an increase of over sixty-nine thousand tons in the importation in eight years, and in the next eight years the increase, of course, will be much greater unless we bring our western sulphur into the market; and it *will* be brought into the market and will compete with the Sicily trade, just as sure as American energy and enterprise *continues* to be what it *has* been in the past.

SYRUP OF WILD CHERRY BARK AND NITROUS ETHER.

By Thos. S. Wiegand.

Read at the Pharmaceutical Meeting, December 21.

A few weeks since, having occasion to make use of a cough mixture composed of acetate of morphine, syrup of squill and syrup of wild-cherry bark, and symptoms arising which rendered the use of sweet spirit of nitre desirable, an addition of 25 per cent. of that preparation was made to the first-named mixture; it apparently produced no

change but that of diluting the mixture, but upon examination the next morning the color was so much deepened that it appeared worthy of investigation. To this end a mixture of the syrups above described was made with spirit of nitre, one of syrup of squill and nitre, and another with syrup of wild-cherry bark and spirit of nitre, all in the proportion of one part of the spirit to three of the syrup.

The syrup first described and that of wild-cherry, became in the course of twelve hours, very much darker, the wild-cherry syrup and nitre if anything, darker than the other, while no perceptible difference could be observed in the mixture of squill and nitre. The change would seem to be dependant upon the coloring matter of the bark and the nitre as no iron could be detected in either the squill or nitre.

PRACTICAL NOTES FROM VARIOUS SOURCES.

By The Editor.

Methylal posesses anæsthetic and hypnotic properties according to the investigations of Personali of Turin (*Nouv. Rémèdes*, Oct. 15, p. 459). On injecting subcutaneously into dogs from 0·10 to 0·15 per cent. of their weight, methylal produced anæsthesia and deep sleep with suspended reflex action followed by rapid recovery and no ill effects. The heart-beats are somewhat augmented, the blood pressure is slightly decreased and the respiration is slower and deeper. It relieves the tetanic spasms caused by strychnine. Applied externally, in the form of liniment or ointment, containing 15 per cent. of methylal, it acts promptly as an anæsthetic; and taken internally, it relieves nervous pains of the stomach.

Methylal was first obtained pure by Malaguti (1839), by distilling 2 parts each of black oxide of manganese and methyl alcohol, with a cold mixture of 3 parts each of sulphuric acid and water, and treating the portion boiling below 60°C. with potassic hydrate. It is a thin, colorless liquid, of an agreeable odor resembling that of chloroform and acetic ether, has at 17°C. the spec. gr. 0·8551, and boils at 42° C. It has a warm, aromatic taste, is freely soluble in alcohol and ether, and dissolves in three volumes of water. Chemically, it is methylene-dimethylether, its composition being $CH_2(OCH_3)_2$ or $C_3H_8O_2$.

Eulyptol is a mixture of salicylic acid 6 parts, carbolic acid 1 part, and oil of eucalyptus 1 part, which Dr. Schmeltz believes (*Bull. gén.*

de Thérap., 1886) to be preferable to most other antiseptics. Since carbolic acid cannot be detected by the usual tests in this mixture, the formation of a chemical compound seems to be indicated. It has a strong, aromatic odor and an acrid, burning taste, dissolves readily in alcohol, ether, chloroform and a mixture of equal parts of alcohol and glycerin, also in alkalies, but is sparingly soluble in water. Urine to which a small quantity of eulyptol has been added, remains unchanged for fully a month.

Hypodermic injection of cocaine and mercury, useful in syphilitic disorders, is recommended by Dr. Mandelbaum (*Monatsh. f. pr. Dermat.*) to be prepared as follows:

Cocaine hydrochlorate	0·050 gm. (gr. ¾).
Mercuric cyanide	0 001 " (gr. ¹/₁₀).
Distilled water	15 drops.

Administration of Paraldehyde.—Dr. R. G. Eccles recommends the following as being the least disagreeable way of administering paraldehyde:

℞ Paraldehyde,

Almond-oil	each, ʒij;
Chloroform	♏x;
Oil of cinnamon	♏ij.

One half to be taken at bedtime, and the remainder during the night, if required. He states that it agreed with the stomach, and would often settle one that was unsettled. It could be taken undiluted.—*N. Y. Med. Jour.*, Dec. 25, 1886.

Thymol as a tænicide and tænifuge, is recommended by Dr. Numa Campi, its action being simple and rapid, and unaccompanied by any disturbance, except a depressing effect, easily counteracted. In the evening he ordered 20 gm. (ʒv) of castor oil to be taken fasting; in the morning he prescribed 8 gm. (ʒii) of thymol, divided into twelve doses, one to be taken every quarter of an hour; twenty minutes after the last dose had been swallowed, another 20 gm. (ʒv) of castor oil were taken. A few minutes after a *tænia medio-canellata* three and a half meters in length was evacuated, the head being dead. The depressing effects were promptly counteracted by the use of stimulants, cognac and rum being suitable for the purpose.—*Buffalo Med. Jour.* Oct. 1886.

The decomposition of ergotin solutions.— As a result of elaborate bacteriological studies, Engelmann, of Kreuznach, presents the following conclusions:

1. Pure ergotin, unmixed, and dispensed in sterilized glass, may be preserved almost indefinitely.

2. Aqueous solutions of ergotin undergo a more or less speedy decomposition. This is due to the action of micro-organisms.

3. Such solutions, when introduced subcutaneously, induce varying degrees of inflammation.

4. The addition of antiseptic agents to such solutions, as ordinarily practised, only delays the decomposition.

5. In order completely to prevent the development of living ferments, the antiseptic must be added in quantities which are directly irritating, and which, in frequent use, are not indifferent in their action upon the organism of the patient.

6. Ergotin solutions may be quite far advanced in decomposition before the eye can detect such change.

7. Ergotin may be most advantageously administered subcutaneously, when dissolved in water previously sterilized by a half hour's boiling.

8. The solution may be best effected in the syringe itself.

9. The distilled water of the apothecaries usually contains bacteria, often to such an extent that from a single drop there may be cultivated upon the gelatin plate many thousands of colonies.

10. In all solutions of drugs to be used subcutaneously, it is therefore advisable that the water should be sterilized by prolonged boiling just previous to its use.

11. The decomposition of pure ergotin has been found to be due to bacterial impurities on the glass vessels used. A large number of micro-organisms cause decomposition in the solutions; the ordinary bacteria of decomposition, however, are the most active.—*Deutsche medicinische Wochenschrift*, Sept. 30, 1886. *Med. News.*

Urinary colorations from chrysophanic acid and from santonin. —It is known that the urine of persons to whom santonin, senna, rhubarb, or chrysarobin have been given takes on a red color when treated with alkalies. In the three last cases, this property is owing to the presence of chrysophanic acid, but we do not yet know the nature of the substance derived from santonin. According to Hoppe-Seyler

one can distinguish the coloration due to santonin from that which chrysophanic acid produces by adding caustic soda to the urine and then shaking up with amylic alcohol. When the coloration proceeds from santonin, the coloring matter passes almost entirely into the alcohol, and the urine is decolorized, whilst, if the color is due to chrysophanic acid, the alcohol takes up only traces, and the urine remains red. On the contrary, if the urine is acidulated, the chrysophanic acid can be taken up by the amylic alcohol; if one then shakes this dissolvent with ammoniated water, the aqueous layer becomes red. Under the same conditions the coloring matter proceeding from santonin is not taken up. The spectrum of these two products totally differs.—*Berliner klinische Wochenschrift. Med. Chronicle,* Oct. 1886.

AMMONIO-NITRATE OF SILVER.

By Harry Napier Draper, F.C.S., M.R.I.A.

It is not a little remarkable that the phenomena attendant upon so familiar a process as the preparation of a solution of silver ammonio-nitrate should remain absolutely unnoticed by the text-books. One of the most recent and best of these indeed warns the student against the evaporation of the liquid "as there is a risk of producing an explosive body," and only one chemist, as far as I can find, has ventured upon an opinion as to the nature of the precipitate formed on the addition of ammonia to silver nitrate. Prescott[1] looks upon it as $(NH_3Ag)_2O$; admitting, however, that this formula is merely hypothetical.

I cannot think that it will be uninteresting if I shortly state the circumstances under which some years ago my attention was directed to this subject. There is a very excellent and frequently used method of glass silvering particularly applicable to the production of telescopic specula, which, shortly described, consists in the reduction by milk sugar of an ammoniacal solution of silver nitrate to which potassium hydrate has been added.

---

[1] *Journal of American Chemical Society,* and *Chemical News,* vol. xlii., p. 31.

I have abundant reason to know that with ordinary precaution this process can be carried out with perfect safety; but that no departure should be made from the prescribed conditions, and that especially the silver solution should not be left about unheeded was sufficiently demonstrated by the circumstance which I now detail.

To a solution of 3·3 gaammes silver nitrate enough ammonia was added to re-dissolve the precipitate at first formed, and then 5 grammes of pure caustic potash. The precipitate produced by the potash was (nearly) dissolved by a further addition of ammonia. The entire volume of the liquid was 50 cc. It was inadvertently left in an uncovered beaker during nine days, and on being then examined its surface was found to be covered with a broken-up, lustrous, graphitic film. The internal walls of the beaker were coated with a closely adherent continuous deposit, which might have been taken for metallic silver, were it not that its color more nearly resembled that of the lead-sulphide which is reduced by sulpho-carbamide. I poured from the beaker into the laboratory sink a perfectly clear liquid, but observing at the bottom a nearly black pulverulent deposit, I, in a weak moment, turned upon this a stream of water from the tap. Here my observations, as regards any practical usefulness, came for the time to an end, for there was a violent explosion which so completely shattered the beaker as not to leave a fragment of it in my hands, which were somewhat severely cut, and I was made deaf for several hours.

It was pretty clear from the outset that under conditions not quite expected, I had inadvertently produced the compound of silver with ammonia known as Berthollet's fulminating silver, and which has also been viewed as a nitride of the metal. These conditions seemed to be sufficiently interesting for examination, and with the double object ofdoing this and of arriving at the principle upon which the silvering process was based, I began a series of experiments.

That up to the present these have not been carried so far as was first intended, is due, firstly, to the fact that at a very early stage of the work the theory of the process became sufficiently intelligible to render its further prosecution unnecessary, and, secondly, to a not unnatural sympathy with the many chemists who, though they have told us something about the physical characters of this remarkably treachous explosive compound, seemed to have unanimously agreed that its

ultimate analysis might be just as well left unattempted. But some of the results obtained (notes by the way, so to speak), affecting as they do the relations between two so familiar bodies as silver and ammonia are I think quite interesting enough to be noted. It is true that I have sometimes found after a tiresome search into the literature of the subject that they had been observed before; but they were so unfamiliar to myself, and are so persistently ignored by the ordinary text-books, that I venture to think there may be others for whom also they may have interest. I propose to state these results in the form of memoranda and as concisely as possible.

When ammonia is added to solution of neutral silver nitrate, the first drop produces a precipitate which is *brownish-white.* As more ammonia is added, the precipitate becomes darker, and just before the point of final solution is reached, it is *dark brown.*

This precipitate is slightly soluble in water.

The smallest addition of nitric acid to a neutral solution of silver nitrate completely prevents its precipitation by ammonia.

The first addition of ammonia to a solution of silver nitrate renders it alkaline to turmeric paper and phenolphthalein, but the solution does not smell of ammonia.

Silver oxide, freshly precipitated by KHO and thoroughly washed, strongly browns turmeric paper.

Freshly precipitated silver oxide is readily soluble in a neutral solution of ammonium nitrate and the solution is strongly alkaline to turmeric paper.

In the following experiments a solution of ammonia was used of which 10 cc. required for neutralization 16·37 cc. of standard solution of oxalic acid. 100 cc. therefore contained 27 grammes NH_3.

To the solution of 8·5 grammes silver nitrate in 70 cc. water the standard ammonia solution was added from a burette until the precipitate at first formed was redissolved.

The quantity of ammonia solution required was 6. 6 cc. (theory requires 6·3 cc.).

Ten test tubes, each containing the solution of 1·7 grammes silver nitrate in 17 cc. of water (the solution having been made neutral by digestion with precipitated silver), were arranged in series. To tube 10 was added just so much of the standard ammonia as was necessary to redissolve the precipitate at first formed. This quantity was 1·3

cc. To the other nine tubes the ammonia solution was added in decreasing proportion, thus :—

Number of tube.	Cubic centimeters NH_4OH added.	Weight of precipitate in grammes.
10	1·30	
9	1·17	0·008
8	1·04	
7	0·91	0·054
6	0·78	
5	0·65	0·076
4	0·52	
3	0·39	0·069
2	0·26	
1	0·13	0·044

In none of the filtrates did either ammonia or silver nitrate give a precipitate. As nearly as could be noted by observation the amount of precipitate increases from No. 1 to No. 3 and in No. 5 seems to attain its maximum.

It then diminished, until in tube No. 9 there was but little apparent precipitate.

To obtain more precise results weighings were made of the precipitates in alternate tubes and the result of these are given in the third column of the table.

As it was obviously important that this precipitate should be examined, and as the maximum quantity obtainable was only equal to 4·47 per cent. of the silver nitrate employed, its preparation on a larger scale became necessary. One hundred and seventy grammes silver nitrate were dissolved in 170 cc. distilled water and 64·5 cc. of the ammonia solution added; just half the quantity required for re-solution of the precipitate. The liquid became very hot, but the filtrate afforded no further precipitate either on cooling or on dilution with water. A determination in it of the silver as chloride showed that only 11 per cent. of the nitrate had been precipitated, and therefore that the remaining 89 per cent. had been dissolved in the ammonium nitrate formed.

The precipitate was collected and examined after being simply air-dried under a bell glass.

Heated at 100° C. it did not lose weight.

Heated to redness, it afforded a residue of metallic silver which was weighed, and the loss of weight compared with that which would have occurred with silver oxide.

(*a*) 1·249 grammes gave Ag 1·141, a loss of 20.60 where $Ag_2O=16$.

(*b*) 0·915 grammes gave Ag 0·836, a loss of 20·01 where $Ag_2O=16$.

The precipitate heated alone, or with potassium hydrate, does not evolve ammonia.

Dissolved in dilute nitric acid, bubbles of gas are evolved.

The precipitate is therefore silver oxide, apparently mixed with silver carbonate, formed by the absorption of carbonic acid gas during drying.

The conclusions which may, I think, be drawn from the foregoing experiments are as follows :—

When ammonia is added to a solution of *neutral* silver nitrate the first addition produces a precipitate of silver oxide (if the solution be acid no precipitate is formed, the oxide dissolving in the simultaneously produced ammonium nitrate). When the quantity of ammonia added is just enough to form ammonium nitrate the reaction

$$2AgNO_3+2NH_4OH=2NH_4NO_3+Ag_2O+H_2O,$$

takes place, but by far the greater part of the silver oxide dissolves in the ammonium nitrate formed, and it is only on the further addition of ammonia and silver-ammonium nitrate ($AgNO_3,2NH_3$) is produced—

$$AgNO_3+2NH_4OH=AgNO_3,2NH_3+2H_2O,$$

a result which may also be obtained by the solution of silver oxide in a mixture of ammonium nitrate with ammonia,

$$Ag_2O+2NH_4,NO_3+2NH_4OH=2AgNO_3,2NH_3+3H_2O$$

This body, described by Mitscherlich,[1] may be obtained by the slow evaporation of its solution. It forms rhombic crystals permanent in the air, and easily soluble in water. Their solution reacts strongly alkaline towards both phenolphthalein and turmeric. When heated—as may be done with perfect safety—they fuse, and leave a residue of metallic silver.

It is this compound which is contained in the ammonia-nitrate of silver solution of the Pharmacopœia, and of our laboratories, and I cannot fitly conclude this paper without pointing out that it is a very

[1] Gmelin,' vol. vi., p. 177.

different substance from that obtained by dissolving silver oxide in ammonia, or by adding potassium or sodium hydrate to any solution of silver containing ammonia. The former may, as I have already noted, be heated even to redness with impunity, while the solution Ag_2O+4NH_4OH, on losing by exposure to the air two molecules of ammonia, splits up with treacherous facility, and probably in the following way:—

$$Ag_2O+2NH_4OH=2AgNH_2+3H_2O;$$

into water and Berthollet's fulminating silver, the body with the mention of which I have introduced this subject, and with which the cultivation of a closer acquaintance is little desirable.—*Phar. Jour. and Trans.*, Dec. 18, 1886, p. 487.

THE ASH OF SOME PHARMACEUTICALLY IMPORTANT SEEDS, FRUITS, ETC.[1]

By H. Warnecke.

As statements respecting the ash yielded by many seeds, fruits and parts of fruits, are entirely absent from manuals of pharmacognosy, notwithstanding that the determination of the ash is of great importance in the examination of a powder for mineral admixtures, the author offers this paper as a contribution to the history of the subject.

In the determination of the ash about 3 grams of a selected air-dried sample was rubbed to a coarse powder in an iron mortar, or in some cases (strychnos seeds, tonka beans, etc.), simply cut into small pieces, and after carefully taking the weight, incinerated in a weighed platinum capsule, in the way recommended by E. Reichardt. The uncovered capsule was brought about 2 centimetres above the opening of a Bunsen burner, and the flame allowed to play over the dish, when the gases evolved ignited and the mass was reduced in two or three minutes to a porous coal. The capsule was then placed obliquely upon the triangle and the incineration continued gently so that only the lower part of the capsule appeared red, the current of air being increased by placing the cover with its concave side inward in the opening of the capsule. After one or two hours the whole of the carbon was burnt off. During the operation stirring was avoided, so that the mass might remain as loose as possible; neither was the flame increased, on account

[1] From the *Pharmaceutische Zeitung*, September 8.

of the volatility of many of the ash constituents and to avoid the running together of the alkaline ash. Finally the capsule was allowed to cool in an exsiccator and weighed.

The following figures refer to the air-dried substance and give the average of several closely concordant analytical results:—

	Per cent.
Semen Colchici	2·66
" Sabadillæ	3·45
" Myristicæ[1]	2·00
Macis	1·39
" after removal of 30·13 per cent. of fat	2·74
Semen Staphisagriæ	9·88
" Nigellæ	3·67
" Sinapis albæ	4·63
" Rapæ	4·36
" Gossypii arborei	4·49
Cotton Seed Flour	6·85
Pasta Guarana	1·36
Semen Cydoniæ	3·55
" Abri precatorii	2·79
" Tonco	3·57
" Hyoscyami	4·51
" Belladonnæ	2·22
" Strychni	1·14
" Ignatii	2·34
" Curcurbitæ	2·88
Fructus Cardamomi	6·12
Cubebæ	5·45
Fructus Cannabis	4·83
" Cocculi	5·20
" Anisi stellati	2·16
Fructus Anisi religiosi	2·02
" Colæ	2·53
" Aurantii immaturi	5·85
Flavedo Fructus Aurantii	3·90
Cortex Fructus Aurantii, with the white inner tssue removed	5·28
" Fructus citri	3·55
" Fructus Belæ Indicæ	2·08
Pulpa Fructus Belæ Indicæ	3·72
Fructus Anacardii occidentalis	1·64
" Anacardii orientalis	2·14
" Rhamin cathartici maturi	2·80
" Rhamni cathartici immaturi	3·67
" Petroselini	7·04
" Carui	5·27
" Ajowan	10·45
" Anisi	6·70
" Fœnicuii	7·25
" Dauci silvestris	5·96
" Cumini	8·09
" Conii	6·69
" Coriandri	5·21
" Pimentæ	4·00
" Capsici	4·66
Piper Cayennense	4·54

Glandulæ Lupuli are required by the Pharmacopœa Germanica to contain less than 10 per cent. of ash, but the author has not met with any sample that answered to this requirement.[2] All the samples were contaminated with sand, which upon shaking with chloroform sank to the bottom, the glands floating above. A sample from Wiggers' collection left upon combustion 15 33 per cent. of residue, whilst other samples from various pharmacists and drug houses, gave 18·14, 23·6,

[1] By boiling pulv. sem. myristicæ with benzol for two hours in a return condenser 41·25 per cent. of fat was removed. The dried residual powder gave 3·77 per cent. of ash.

[2] The British Pharmacopœia allows 15 per cent., the U.S.P., only 8 per cent.

and even 44·76 per cent.; of the last mentioned 4 to 5 per cent. dissolved in hydrochloric acid the remainder being admixed sand. In order to ascertain the true ash content of hop glands the author tried to free a quantity from sand by washing it with water six times in a large beaker. After drying over sulphuric acid the lupulin gave upon incineration an average of 10·81 of residue, which still contained some sand adherent to the sticky glands. Flückiger found in a good sample, dried in a water bath, 7·7 per cent. of ash.

In conclusion the author estimates the ash in ipecacuanha root at 1·98 per cent.; the wood giving 1·37 per cent. and the bark 2·25 per cent.—*Phar. Jour. and Trans.*, Sept. 23, 1886, p. 330.

ON ETHOXYCAFFEINE.

By D. J. Leech.

Four or five years ago Fischer (*Berichte der deutsch. chem. Gesellschaft*, 1881 and 1882, see Amer. Jour. Phar. 1882, p. 218, and 1883, p. 551), published a series of papers bearing on the chemical constitution of caffeine, theobromine, xanthine, and some of their derivatives. He showed that a close relationship exists between these three substances, theobromine being dimethylxanthine, that is xanthine in which two equivalents of hydrogen are replaced by two of methyl, whilst caffeine is trimethylxanithine, three equivalents of hydrogen being here replaced by three of methyl. He showed, too, that it is possible to carry such substitution farther, and to replace one or two atoms of hydrogen in the caffeine by one or two of hydroxyl, methoxyl, or ethoxyl. By so doing compounds are produced to which he gave the names hydroxycaffeine, dihydroxycaffeine, ethoxycaffeine.

Filehn (*Archiv für Anat. und Phys.*, 1886) records experiments on the physiological action of the compounds thus formed. He finds that 0·2 gm. of hydroxycaffeine is required to produce on the muscular system of the frog such rigidity as follows 7 milligrams of caffeine. If two equivalents of hydrogen be replaced by hydroxyl the compound (dihydroxycaffeine) produces no effect on the muscular system. So far the experiments only indicated another interesting relationship between chemical composition and physiological action, but his examination of ethoxycaffeine seems likely to be of direct therapeutic

value. He found that in frogs the substitution of an atom of ethoxyl for an atom of hydrogen in caffeine effected a very great modification in physiological action, for ethoxycaffeine, instead of causing rigidity of the muscles and tetaniform spasm, has a narcotic effect and diminishes reflex excitability.

Trying next the effect of the new compound on mammals he found that 0·5 gm. caused sleep in rabbits, spinal symptoms only appearing after the administration of a gram. Experimenting finally on man he noted vertigo, intellectual torpor, sometimes also pain in the head, after the exhibition of 0·5 to 0·75 gm. of ethoxycaffeine, and suggested the possibility that it might be useful in migraine.

Dujardin-Beaumetz (*Bull. gén. de Thérap.*, March 30, 1886,) has made further experiments with a quantity of the drug placed at his disposal by Filehne. It is in the form of white crystals, and quite insoluble in water, but like caffeine, its solution may be effected by the addition of salicylate of sodium. On injecting 0·01—0·08 gm. into the guinea-pig he noticed increased action of the heart and diuresis, and also sleepiness, with such paresis of the eyelids that the animal could hardly open its eyes even when stimulated. The drug was rapidly eliminated by the urine, but a larger dose than 0·1 gm. caused convulsions and death.

Dujardin-Beaumetz next tried the drug on patients suffering from pains in the head, giving 3—15 grains per diem, either in cachets or solution. It is apt to cause stomach troubles, heat at the epigastrium, nausea, and vomiting, and as this is especially the case when it is given in catches he employed the following solution:—

Ethoxycaffeine	3¾gr.
Salicylate of sodium	3¾gr.
Hydrochlorate of cocaine	1½gr.
Syrup and water	3oz.

The cocaine is added to minimise gastric irritation.

In facial neuralgia 7½—15 grains daily gave relief and even caused sleep, but its action did not compare favorably with aconitine. But in migraine he obtained very satisfactory results from the new drug by giving 3¾ grains as soon as the symptoms of the attack appeared. To one of his pupils, who suffered from intense migraine, he gave 7½ grains of ethoxycaffeine. Two hours afterwards the pains had completely disappeared, and the patient slept. On awakening there was neither pain nor loss of appetite. In another case, 3¾ grains given at

the height of an attack gave relief in an hour. A larger dose than 3 or 4 grains, should not, as a rule, be given; 7—8 grains is apt to cause cramp, nausea, and a sensation of discomfort.

Dr. Chabot, a pupil of Dujardin-Beaumetz, records other cases of the successful treatment of migraine by ethoxycaffeine. In a man, aged 52, with a very painful zona, 15 grains of ethoxycaffeine taken in five doses at intervals of half-an-hour, procured sleep, which morphine injections had failed to induce. A nervous and anæmic woman, suffering from almost constant cephalagia and insomnia, found 7½ grains, given in five doses, to cause sleep. On previous nights opium had produced but little rest. In this case some nausea and vomiting followed the use of the drug. Two other successful cases are also recorded, and it seems possible that we have in ethoxycaffeine a powerful agent for cutting short attacks of migraine.—*Med. Chronicle*, November 1886, p. 138.

NOTE UPON THE CONVERSION OF STARCH INTO GLUCOSE BY MEANS OF HYDROCHLORIC ACID.

By Sidney Harvey, F.C.S.

Read at Meeting of Public Analysts, November 10th, 1886.

A paper on the analysis of pepper, by Mr. Heisch, read at the Maidstone meeting, and printed in the October number of the *Analyst*, includes a process for starch estimation by means of hydrochloric acid and the polarimeter, and as a great number of methods are recommended in various works for this purpose, and the above appeared to be definite, simple, and easy of execution, I was anxious, at the earliest opportunity to verify the results, and with that object I have, during the last six weeks, made a large number of experiments.

It must be understood that I confined myself *exclusively* to the action of solution of "HCl" upon the purest starches I could obtain, and I started with the following assumptions, viz. :—

(1) That incomplete conversion into dextrose by boiling with "HCl" would be shown by the polarimeter yielding excessively high results (when calculated as dextrose) as compared with the estimation by means of "copper," due, of course, to the high rotating powers of the intermediate principles formed.

(2) That an agreement between the results afforded by the optical and copper methods, while proving the conversion to be complete, required necessarily to tally with the real amount of dextrose known to be represented by the quantity of starch operated upon.

My procedure was as follows:—Ten grammes of starch were heated in flask provided with condenser, with 190 cc. of the dilute "HCl" for the prescribed time. The solution was next cooled, made up to 200 cc., and filtered, in some cases decolorized. It was subsequently polarized, using the half-shadow instrument; a portion was also neutralized, suitably diluted, and estimated volumetrically by "copper."

Repeated experiments were made in both cases, and the averages taken.

My results are tabulated below, and may be summed up thus:—

(1) That immersing the flask containing the mixture in a boiling-water bath was equally efficient with boiling by the direct application of flame.

(2) That in all cases where the conversion was complete my results were *seriously below* the truth to the extent of from four to seven per cent.

(3) That it was difficult, if not impossible, so to limit the time of heating as to prevent the destruction of some of the newly-formed dextrose.

(4) That prolonged heating resulted in regularly diminishing dextrose.

In conclusion, while regretting my inability to confirm some of Mr. Heisch's results, I am of opinion that the main issues of that gentleman's paper continue unaffected, viz., that the percentage of starch in ash and water-free pepper is remarkably constant, and that the estimation of the former affords valuable aid in the analysis of the latter.

I would also refer to some researches bearing on this subject by F. Allihn, published in the *Journal of the Chemical Society*, vol. 46 (abstracts), p. 721, in which the results appear to confirm mine.

I have also pleasure in acknowledging the assistance of my friend and pupil, Mr. John Howard, during my long and somewhat tedious work.

Composition of starches operated upon:

	Wheat.	Rice.
Dry starch...	85.56	86·61
Water.....	13·63	12·77
Impurities...	0·81	0·62
	100·00	100·00

100 parts of starch operated upon in every case.

Dry Starch.	Equivalent in Glucose.	Method.	Time.	Stren'th of HCl.	Glucose by Pol'm'ter.	Glucose by Copper.	Result.
Wheat 85·56	95·07	Boiled direct	2 hours	10 p. c.	87·80	87 75	loss
" "	"	Water-bath	3 "	10 p. c.	88·24	88·26	loss
" "	"	"	1 hour	5 p. c.	93·76	91·08	incompl'te
Rice 86·61	96·23	"	1 "	10 p. c.	91·84	91·74	loss
" "	"	"	2 hours	10 p. c.	90·86	90·91	loss
" "	"	"	3 "	10 p. c.	89·94	90·09	loss
" "	"	"	30 min.	10 p. c.	129·98	——	incompl'te
" "	"	"	50 "	10 p. c.	101·38	84·74	incompl'te
" "	"	"	2 hours	10 p. c.	91·84	84·74	loss

—*The Analyst*, December, 1886, p. 221.

THE OTTO OF ROSE INDUSTRY.

Mr. Ernst Schmalfuss, a German horticulturist, has been spending a considerable time in Bulgaria to investigate the conditions of the otto of rose industry in that country. Mr. Schmalfuss went to Bulgaria as the agent of a German firm of essential oil distillers who have lately been endeavoring to create an otto of rose industry in Germany, and who desired to have an expert's opinion on the question whether it is feasible to grow the Thracian rose in Western Europe.

The information which has been collected belongs of course to the firm who bore the expense of the journey, but Mr. Schmalfuss has obtained their permission to publish certain details on the subject of his investigations. Mr. Schmalfuss went to Bulgaria with an open mind, and returned thence a firm believer in the future of an otto industry in Western Europe.

There are two principal rose-growing districts in Bulgaria, the one extending from Yeni-Sagra to Carlowa on the southerly slopes of the Balkans, and the other situated near Chirpan, south of the Karadsha-Dagh. The most widely-different estimates prevail regarding the total area under cultivation, and no reliable figures are obtainable. There is much variation in the soil of the rose-districts, the prevailing formation being a light loam, rich in lime (1·26 per cent.) but almost devoid of phosphoric acid, of which only traces were found in a sample sent to Germany for analysis.

The proportion of nitrogen is moderate, being 0·14 per cent., but the soil is remarkable for its richness in potassium, of which 0·64 per cent. was present in the specimen analyzed. It is not known whether the presence of potassium exercises a special influence on the growth of the flowers; if so, the application of potash-manure would be advisable. In Bulgaria the rose-fields are sheltered from the north wind by the mountain ranges against which they are situated, but it is thought that it would be rather an advantage than otherwise if they were from time to time exposed to a cool wind, the plants being singularly hardy and able to withstand without injury a temperature of –4° Fahr. On the other hand, scarcely a season passes in which the plants do not suffer from excessive heat, the high temperature prevailing during certain months being, in fact, the greatest enemy of the shrubs during the flowering and gathering time.

The variety which is used for distilling purposes in Bulgaria is the so-called Thracian rose, a plant of exceedingly rapid growth, flowering sparingly in the first year, and yielding a full crop on the third, when it attains maturity. It is said that, under certain conditions, the plants attain an age of fifty years. The plant bears red or white flowers, the former being about five times as numerous as the latter. Both varieties of flowers are of a very powerful and agreeable odor, but the oil distilled from the white flowers is the finest, although the red roses are richer in essential oil. The Thracian rose exceeds all other varieties in flowering property, weak specimens bearing as many as 500 flowers, while fine plants, if properly cultivated, are able to produce nearly double that number. The roses are small and light, about 220 fresh flowers going to the lb., or about twice the number of ordinary centifolia flowers which are required to make up that weight.

The flowers of the Thracian rose are rather thin, and their richness in essential oils lies in the ovary and the stamens (of which there are an extraordinary number), rather than in the petals. For distilling purposes the entire flower of the Thracian rose is taken, while of the other varieties the corolla leaves alone are employed. Almost every small Bulgarian farmer distils his own oil, the stills used being of the most elementary description, and it is thought that if a Western firm were to undertake the distilling a larger percentage and better quality of oil might easily be obtained. The roses are grown in fields, where they are placed in rows about 2 yards apart, and alternating with rows of grape vines or kitchen vegetables. To a practical man it would appear that in the Bulgarian fields the plants are grown too closely together and have no room left to expand properly. As hints to intending experimenters in Western Europe, Mr. Schmalfuss recommends that the soil should be well manured with old, partly-decomposed manure, the application of which should be repeated every third year. The plants should be placed in rows, about 8,000 trees to the acre, and during the first two years the rows of rose-plants may alternate with rows of kitchen vegetables. It may be found to pay to cut the shrubs in the second year close to the ground. The yield of that year is of course lost by this proceeding, but the luxuriance of the plant for the future is thereby much increased. After the third year the planting of vegetables must be discontinued. The soil must be kept free from weeds and rendered loose twice a year by hoeing. The fields might, experimentally, be protected at the north side by hedges. The flowers must be gathered early in the morning and placed loosely in open baskets, which should be kept in the shade.

Of the roses common in Western Europe the light and dark red varieties of moss, Bourbon, and Remontant roses are richest in essential oil, and might be employed advantageously, Mr. Schmalfuss thinks, so long as the Thracian roses are not obtainable in quantities. Unfortunately, it would appear that, for the present at least, there is no prospect of a supply of Thracian roses sufficient to admit of a proper experiment. When Mr. Schmalfuss commenced his investigations in Bulgaria he did not meet with any considerable opposition on the part of the native otto merchants, who, at that time, appear to have been perfectly skeptical regarding the possibility of the remunerative distillation of otto outside

their own country. But when Mr. Schmalfuss, encouraged by his success, endeavored to obtain a first wagon-load of plants for export to Germany, the Bulgarian otto trade suddenly raised an outcry and prevailed upon the Government to issue an order strictly prohibiting the export of plants. Efforts will be made to obtain the repeal of this order, and Mr. Schmalfuss' friends are sanguine that at any rate they will ultimately succeed in obtaining a sufficient number of plants; but for the moment their plans, so far as the wholesale import of Tracian roses into Germany is concerned, are frustrated.—*The Chemist and Druggist,* December, 1886, p. 809.

NOTES ON A SAMPLE OF GALBANUM FROM FERULA GALBANIFLUA.[1]

By E. G. Baker.

The following are a few notes on a sample of galbanum collected by Dr. Aitchison, Surgeon-Major, in Afghanistan, and brought back by him, together with the plant from which it was collected. The plant has been identified by Mr. Hemsley, of the Kew Herbarium, as *Ferula galbaniflua,* Boiss. et Buhse.

The gum-resin consisted of agglutinated tears of a white or reddish-brown color, usually compact and hard, but softening if held in the hand.

When broken it presents a dull white waxy fracture resembling ordinary ammoniacum, in fact, judging from external appearances, it might easily be mistaken for a sample of that drug.

Its odor is peculiar, but not unpleasant. Mixed with the gum-resin, portions of the stem from which it was obtained were found.

From the sample handed over to me for examination, a portion was selected fairly representative of the whole; this was powdered and sifted through muslin, and then treated with the following solvents:

Petroleum Ether.—Of the sifted gum-resin I took 5 grams, and treated it with 50 cc. of petroleum ether—allowing the mixture to remain in a suitable vessel for several days, during which time it was frequently agitated. I then decanted the fluid portion into a tared dish, rinsed the vessel out with more petroleum ether, and evaporated

[1] Read at an Evening Meeting of the Pharmaceutical Society, Wednesday, December 8, 1886.

the whole of it as recommended by Dragendorff, in a current of dry air, the air being dried by passing through sulphuric acid and over chloride of calcium.

The petroleum ether extracted ·1254 gram; adding to this ·03 as the loss during evaporation would give ·1554 gram or 3·1080 per cent.

Ether.—The portion of the 5 grams remaining from the petroleum ether extraction was next treated with ether and allowed to remain as before. This was decanted and evaporated over a water-bath. It was only after several days that the weight was found to be constant, at the latter stages of the operation the evaporation taking place slowly. The matter extracted by ether was found to weigh 3·060 grams. This was then treated with alcohol, in which it was almost wholly soluble, ·226 gram of the 3·060 grams remaining undissolved.

The alcoholic extractive was evaporated, and consisted of a brittle resin, the melting point of which, when taken over mercury, was found to be 57° C. The resin was soluble in soda, from which it was reprecipitated by an acid.

Alcohol.—The portion of the gum-resin remaining from the ether extraction was next treated with alcohol. The resulting fluid was evaporated over a water-bath. The residue weighed ·3788 gram.

Water.—The portion of the gum-resin remaining from the alcohol extraction was next treated with distilled water. The filtrate evaporated over a water-bath yielded ·8514 gram of residue.

The latter was again treated with water, and various reagents applied. With ammonium oxalate and subacetate of lead the solution of gum gave copious precipitates, but none with acetate of lead or borax.

Insoluble Matter.—The portion of the gum-resin insoluble in petroleum ether, ether, alcohol and water, was found to weigh ·5280 gram.

Volatile Oil and Moisture.—·7876 gram of the powdered gum-resin above referred to was next taken; this, after several days' evaporation, lost ·042 gram, which would represent 5·332 per cent., and would be the volatile oil and moisture.

Ash.—In order to determine the ash 1·5792 gram of the gum-resin was taken and burnt in a furnace. The ash, which was white, weighed ·039 gram; this would represent 2·463 per cent.

Upon examination the ash was found to consist of carbonates of calcium and sodium, sulphates and phosphates being absent.

When examined by the spectroscope the sodium and calcium bands were plainly visible. There was also a band in the red to the right of the calcium bands, which might possibly be strontium. The quantity present was not sufficient for a determination of its position.

Action of Gum-Resin with various Reagents.—Sulphuric acid turned the gum-resin dark brown. Hydrochloric acid gave no well-marked action in the cold, but when a portion of the gum-resin was boiled with this acid a dirty red color was obtained, which underwent no change on the addition of alcohol.

A small portion of the gum-resin was boiled with water, and when cold, ammonia added; a very slight blue fluorescence was visible, which indicates the presence of umbelliferon $C_9H_6O_3$. To confirm the result a portion of the gum resin was heated for some time with hydrochloric acid at 100° C.; this, when cold, was put into a glass separator with some chloroform, and after agitation, the chloroformic layer drawn and evaporated. No crystals were visible, but when the evaporated chloroformic layer was extracted with water and ammonia added, a decided blue fluorescence was seen.

I then fused a portion of the gum resin with nitre, extracted the mass with water, and added barium chloride; this gave a precipitate wholly soluble in acid, indicating the absence of sulphur in the drug.

The analysis is then as follows:

	Grams.	Per cent.
Volatile oil	·1554	= 3·108
Ether extractive } resin	3·0600	= 61·200
Alcohol extractive } resin	·3788	= 7·576
Water extractive, gum	·8514	= 17·028
Insoluble matter	·5280	= 10·560
	4·9736	

The foregoing experiments were made in the Pharmaceutical Society's Laboratory, by permission of Professor Attfield.—*Phar. Jour. and Trans.*, Dec. 11, 1886, p. 468.

SOME PLANTS OF AFGHANISTAN, AND THEIR MEDICINAL PRODUCTS.[1]

By J. E. T. Aitchison, C.I.E., F.R.S.,
Brigade Surgeon, Bengal Army.

During the month of August, 1884, I was appointed by his Excellency the Viceroy and Governor-General of India, the Marquis of

[1] Read at an Evening Meeting of the Pharmaceutical Society of Great Britain, Wednesday, December 8, 1886.

Ripon, Naturalist with the Afghan Delimitation Commission. The British Commissioner, Sir Peter Lumsden, G.C.B., coming direct from England, joined the Indian portion of the mission in the vicinity of the proposed boundary. The party from India, commanded by Colonel—now Sir West—Ridgeway, left India in the end of August, Quetta on September 22, 1884, marched through northern Beluchistan to the Helmand, thence through Afghanistan to Khúsan, which was reached on November 18. During 1885 I travelled over a great extent of country in northern Afghanistan and Persia, finally left the mission on August 16, 1885, proceeding through Khorasán *viâ* Meshad and Astrabad to the Caspian, thence *viâ* Baku, Batoum and Constantinople to England.

In making my collections it was one of my principal aims to obtain those plants which yielded products of commercial value, and personally to collect from the living plant the product it yields, taking nothing for granted or on heresay only, hoping thus to assist materially in elucidating the many diverse opinions held relative to the substances themselves, as well as to the plants that yield them. I also considered it of great importance to obtain good specimens for botanical identification, with seeds for cultivation, and when possible, the local names of the plant and product were noted. I need hardly tell you that this was but a fragment of my work, having brought to England some eight hundred species of dried plants, amounting in all probability to ten thousand specimens, in addition to my numerous zoological collections. Although the work was intensely interesting it was of necessity laborious, and the difficulties to be overcome were numerous, but now that I have begun to discover the value of the material amassed, these troubles and labors are well nigh forgotten.

The class of plants with their products, upon which I propose speaking to you first this evening, and in which I feel sure you will be most interested, is the *Umbelliferæ* which form the characteristic vegetation of the region under consideration. The country in which these *Umbelliferæ* flourish consists of the great shingle and conglomerate plains lying between the hills and the beds of the rivers, which are broken up by numerous ravines and traversed by what are usually dry water courses, which once in every two or three years, on the occurrence of heavy falls of snow on the hills above, or local showers of rain, suddenly become roaring torrents. The altitude of these plains above the sea level ranges from 2,000 to 4,000 feet. These

plains during winter are perfectly treeless, arid, and bare, the only signs of a past vegetation being the gnarled remains, scarcely over a foot in height, of a few shrubs. As one gazes on this desert-like country, extending on all sides, one wonders whether it could possibly produce even a blade of grass in summer. To make things worse, there is little or no water, which to the traveller is a matter of risk and difficulty, owing to the distances between the springs and the uncertainty of the supply. As summer advances a complete change comes over the scene; these bare plains become rapidly covered with a mass of splendid verdure produced chiefly by the presence of the following umbellifers, viz., *Ferula fœtida*, Regel, *Dorema Ammoniacum*, Don, and *Ferula galbaniflua*, Boissier and Buhse. The two former usually occur associated together, whereas the latter is generally found alone. The habit of growth of these three species is much the same; they all produce a great show of foliage thrown out from their perennial root stocks. This foliage spreads out on the ground to nearly three feet, forming a circle round the base of the flowering stems, little under six feet in diameter, and it is the close approximation of the foliage of adjacent plants that gives to the country in which they grow its wonderful appearance of a never-ending pasturage. Upon each species throwing up its own peculiar form of inflorescence, the landscape becomes much altered, more especially with regard to the appearance presented by *Ferula galbaniflua*. When this is in full flower, with its golden-colored panicled inflorescence from three to four feet in height, representing a miniature forest, the sight is one to be dreamed of rather than believed in or described. This wonderful verdure lasts from the end of April to the beginning of July, by the end of that month it has as suddenly disappeared as it originated, even to the fruit-bearing stems. The hot sun dries the plants to a cinder, and the prevailing winds finish the work of destruction so thoroughly, that by August not a trace of the past season's vegetation is left.

Ferula fœtida, Regel, syn. *Ferula Scorodosma*, Bent. and Trim.; *Scorodosma fœtida*, Bunge.—The plate in Bentley and Trimen's 'Medicinal Plants' is a most excellent one of the plant in fruit. The native name for the asafœtida plant near Herat is *Angúza-kéma, Kúrné-kéma, Khora-kéma*. *Kema* may be considered the generic term for all the Ferulas and Doremas. *Anguza* is the term for the product asafœtida, and is what in India is called "*hing*." This last name is also applied to it by traders in these parts.

In early spring great cabbage-like heads are to be seen distributed at intervals amongst the asafœtida plants. Their peculiar forms represent the primary stage of the flower heads, enclosed and completely covered up by the large sheathing stipules of its leaves. In a few days these heads become transformed into the semblance of a cauliflower; from this period the stem bearing the inflorescence rapidly shoots upwards to a height of from four to five feet, its proportions being singularly massive and pillar-like. From a general calculation I found that only one out of a hundred plants bore a flowering stem. If you ask a native what plant this is, pointing to a flower-bearing one, he will tell you that it is "*kurné-kéma*," and that it has nothing to do with the plants that yield asafœtida. He will take out his knife, remove the head, cut the stem from its base, strip off the few sheathing stipules that are still adherent to the stem, and in his hand you see what looks like a very large cucumber: from this he will remove the dark-green cuticle, and then slice away at the deliciously cool, soft, crisp, copiously milky stem, and eat slice after slice with the greatest gusto, and then say, "Did I not tell you it was the edible *kéma*, and not asafœtida?" "Yes," says an onlooker. "You will stink like a camel for the next three months!" The method of collecting the drug, as far as I could learn, was as follows: A few men, employed for the purpose by some capitalist at Herat, are sent to these asafœtida-bearing plains during June. These take with them provisions, consisting of flour, and several donkey-loads of watermelons, the latter in lieu of water, which is not only scarce there, but usually saline. The men begin their work by laying bare the root stock to a depth of a couple of inches of those plants only which have not as yet reached their flower-bearing stage. They then cut off a slice from the top of the root stock, from which at once a quantity of milky juice exudes, which my informant told me was not collected then. They next proceeded to cover over the root by means of a domed structure, of from six to eight inches in height, called a *khora*, formed of twigs and covered with clay, leaving an opening towards the north, thus protecting the exposed roots from the rays of the sun. The drug collectors return in about five or six weeks' time, and it was at this stage that the process of collecting came under my personal observation. A thick gummy, not milky, reddish substance now appeared in more or less irregular lumps upon the exposed surface of the roots, which looked to me exactly like the ordinary asafœtida of commerce, as

employed in medicine. This was scraped off with a piece of iron hoop, or removed along with a slice of the root, and at once placed in a leather bag, the tanned skin of a kid or goat. My guide informed me that occasionally the plant was operated upon in this manner more than once in the season. The asafœtida was then conveyed to Herat, where it usually underwent the process of adulteration with a red clay *táwah*, and where it was sold to certain export traders, called *Kákri-log*, who convey it to India. On August 17, when I crossed the great asafœtida plains where this drug is chiefly collected, except for the small domes over each root, there was not a leaf or a stem or anything left to point to the fact that any such plant had ever existed there, the heat and winds of July and August having removed every trace.

In northern Beluchistan, after much difficulty and searching, I came across one root of asafœtida, which I believe belonged to a different species; but I did not see a single stem, or even the remains of one, although we traversed immense plains upon which these fragments of leaves still existed, and where, I believe, during summer the plant must have grown in abundance.

Dorema Ammoniacum, Don.—This is the *Kandal-kéma* of Afghanistan, or, in other words, the *kéma* that yields the product *Kandal*, and which appears to me to be ammoniacum. As already stated, this grows along with asafœtida, *Ferula fœtida*, Regel. It is equally abundant with the latter, and occupies similar localities, having much the same habit. When these two plants have produced their base leaves only, it is almost impossible for any one to distinguish between them, and both, on injury, yield a milky juice. On the flowering stem beginning to shoot, the Dorema is readily recognized, as the immature flower head shoots forth uncovered by any sheathing stipules, and in the form of a panicle, with the peduncles not spreading from the main stem. As the stem becomes fully matured, one-sided nodes form on it at irregular distances, which give to it an undulating appearance characteristic of the plant. The plate of this plant in the 'Memoirs of the Imperial Academy of Science at St. Petersberg,' by Borszczoff, is excellent, though the peculiar enlargements on the stem are not sufficiently indicated. When it has reached its fruiting condition, it is very liable to be attacked by a boring insect, especially in the fruiting heads, the result of which is the rapid escape of a large amount of a milky fluid, which, upon exposure, soon becomes tenacious and gummy, forming into solid concrete lumps of a grayish

opalescent color. This substance in these parts is the *Kandal* or *Ushak* of commerce. It is collected simply by removing the lumps from the surface of the plant, or, if later in the season, from the ground. No means are taken to increase the flow of fluid from the stem artificially. Between Bezd and Shér-i-nao a large quantity of *Kandal* grows, and it is there gathered for exportation.

I may mention here that *Dorema glabrum*, which attains a height of from ten to twelve feet, grows in great abundance, along with tamarisk, in the Nehal shéni portion of the Badghis territory, forming thickets in the stream beds. It yields a gum-resin. I also collected a very distinct new species of a *Dorema* with foliage resembling *Ferula fœtida.*

Ferula galbaniflua, Boissier and Buhse.—The plate of this in Bentley and Trimen is not sufficient, owing to the imperfect material they had to work with. Our plant differs from Boissier's description, in having a perfectly hollow stem and woolly petals; but this woolliness so entirely disappears in the herbarium, that unless seen originally one would doubt its having ever existed. Notwithstanding these discrepancies, we have no doubt that it is *F. galbaniflua*, Boiss. et Buhse. The native name for this plant is *Brada-kéma.* In habit it differs from the two already described species, in growing gregariously, and in its being found in greatest luxuriance in moister localities, as in the Badghis near Gulran, where it grows in the sandy loam of that district. Its early root leaves spring from the ground like a fountain of soft green moss, and in this state it is greedily devoured by camels. The stem, which grows very rapidly, is of a semi-opalescent orange color when young and perfectly glabrous. When in full blossom the flower is of a brilliant orange-yellow; as the fruit forms and ripens the color changes from the base of the plant upwards, showing various autumnal tints. The stem is thick at the base but tapers suddenly upwards, terminating in an elegant tall, loose, panicled inflorescence, reaching a height of about four feet. The stem, on injury, from its earliest stage of growth, yields an orange-yellow gummy fluid, which very slowly consolidates, usually forming on the stem, like the grease on a guttering candle, and possessing in common with the whole plant when crushed a strong odor resembling that of celery. The gum is commonly found adhering to the lower portions of the stem, and is so tenacious that when subsequently examined pieces of the plant are frequently found attached to it. This

substance is called by the natives *Shilm-i-badra-kéma, Shilm-i-barzat, Birzand-Jao-shír.* No artificial means are employed to my knowledge in the collection of this drug. It is stated to be an article of export through Persia *viâ* the Gulf to Arabia and India. In Persia and Afghanistan it is said to be administered to parturient women, and the entire shrub is hung round the house to keep off evil spirits whilst parturition is actually taking place.

Ferula suaveolens, Aitch. and Hemsley, *sp. nov.* This is a new species of *Ferula* that comes under the division *Euryangium.* It is a plant from three to four feet in height, and grows, at an altitude above 5,000 feet in the hills to the south of Bèzd. The root of the plant, called *Sambal,* is scented, and is collected and exported from Turbat-i-Haidri, through Persia, to the coast. The shrub itself is called *Kéma,* but so are all these large Umbelliferæ. It has a solid stem, with nodes on it much resembling those of *Dorema Ammoniacum,* and also yields some form of gum-resin, which, however, I was unable to collect.

Trachydium Lehmanii, Bth. and Hooker, syn., *Eremodaucus Lehmanii,* Bunge, and *Albertia margaritifera,* Regel and Schmalh.—The roots of this species are not thicker than a goose quill, and from three to four inches long, tapering off to a point. They are collected as a drug under the name *Shákh-akhal,* and exported from Herat. It is curious to note that generally on the central flower of the umbel there is a piece of gummy rose-red exudation, the result of injury by an insect.

Psammogeton setifolium, Boiss.—The fruit of this plant is largely collected and employed as an aromatic stomachic in Persia; it is a very common annual, generally met with over the whole country.

I would now proceed to draw your attention to the several kinds of manna, and their sources, which are produced in this country. There are three kinds which are usually met with, and which form articles of export. The first, and that most largely exported, is an exudation that occurs in certain seasons and years upon *Cotoneaster nummularia,* Fisch. et Mey. The plant is called *Siah-chob* (black stick) and the manna *Shir-kisht,* meaning hardened milk. This cotoneaster is a tall stout shrub, growing occasionally to twelve or fourteen feet in height. It is met with throughout the Paropamisus range and in Khorasán, at an altitude of about 5,000 feet. Although common everywhere in these hills it is found in greater abundance on the Siah-

koh and Safĕd-koh and the Ar-dewán pass, forming regular thickets; these are also the noted localities for obtaining the manna. During July, as the corn ripens, the smaller branches of the cotoneaster become covered with the exudation, and this is collected by merely shaking the branches over a cloth. It is eaten largely by the people as a sweetmeat, and exported in quantity to Persia and India.

The second kind of manna is that yielded by the camel-thorn, *Alhagi Camelorum*, Fisch. This is a thorny shrub of from two to three feet in height, growing generally over the country at an altitude of two thousand feet, very frequently gregarious, forming a dense shrub. In certain years, during the months of July and August, this manna is developed on the branches of the camel-thorn (*Shutar-khár*), or goat's-thorn (*Khár-i-búzi*). The manna is called *Taranjabin*, which means the honey from the green (bush), this name probably originating from the shrub remaining vividly green over the country long after all other plants have dried up and disappeared. The country round Rui-khauf, in Persia, is celebrated for this product, whence it is exported in all directions.

The third kind of manna is that yielded by *Tamarix gallica*, Linn., var. *mannifera*. I collected specimens of this plant in the Badghis, where it was pointed out to me by a Persian as being the shrub that in Khairan Persia yielded *Gaz-shakar*. The plant in Afghanistan is called *Gaz*, and the manna it yields *Gaz-anjabin;* the latter I did not find.

At Sha-Ishmael, on October 8, 1884, I collected a quantity of manna in the form of milk drops from the foliage of *Salsola fœtida*, Del. It was pleasant to the taste, with a slightly aromatic flavor. This, I regret to say, has been lost.

Glycyrrhiza glabra, Linn., and its variety *glandulifera*, Reg. et Herd.—This shrub in one form or other is very common all over the Badghis, and throughout the Hari-rúd and Khorasán districts, near water. Its annual stems grow to great coarse shoots of from four to five feet in height from enormous underground root stocks. The Turkomans prepare from its roots the extract liquorice, which as well as the shrub they call *Mahk*. The Persians call the plant *Sús*, the root *Behk-sús*, and the extract *Rob-i-sus*. Liquorice is not manufactured at Meshad, but I was told that it was imported from Yezd and Fars in Persia, as well as from Turkistan. I obtained a preparation of it made by boiling the extract down in whey, which gives it a

saline flavor, making the liquorice more palatable. This preparation is called by Turkomans *Ao-karût*, the same term as they apply to whey.

Astragalus heratensis, Bunge, and *Astragalus sp.* near *A. strobiliferus*, Royle.—These two species of Astragalus are very common in stony soil in the Hari-rúd valley and Khorasán, at an altitude of three thousand feet. The native names for either of these were *Khon*, *Kon* and *Gabina*, and for a gum that exudes from them *Katira*. This gum was found attached to the stem in the peculiar form of tragacanth, wherever it had been able to make its way out through fissures in the bark, and on cutting the stem across the gum was seen to protrude from the medullary space. It is collected in large quantities in the neighborhood of a village called *Kalla-roving*, near Bezd, in Khorasán, for exportation to India *viâ* Herat, and to the sea coast of Persia.

Rheum sp. near *R. songaricum*, Schrenk.—I found a very handsome species of rhubarb on the great plains in the Hari-rúd valley, near Tomanagha, at an altitude of two thousand feet; this the natives call *Rewash-i-dêwana*, viz., fool's rhubarb, *Rewand-i-méghan*, *Ishkin*. It is very peculiar in its growth, producing three enormous basal leaves, which spread out flat on the ground, each being about four feet long by five feet across, and the flowering stem with a loose spreading panicle of flowers reaches a height of about three feet; the fruit is large and winged, ripening to a ruby red. The ripe fruit is collected and employed as a purgative, and when not procurable, the root is substituted. I am glad to say that I have been able to obtain a large quantity of the seed, which has been distributed to several gardens; some plants have already sprung up, and are doing well in the gardens at Kew.

Orchis laxiflora, Linn., and *Orchis latifolia*, Linn.—I obtained the two species of orchis in a few localities in the Badghis, the Hari-rúd valley, and Khorasán, and near Meshad I came across people digging for the tubers of these orchids, which they called "sálab" and "sálap."

In several places where I had purchased the dry tubers I was told by the vendor that they were not procurable in Afghanistan, but only near Meshad. There can now be no doubt from my identifications on the spot that the tubers generally exported from Meshad into India through Afghanistan are those of the above species. In Meshad I was informed that these were *Sálap*, but not *Sálap-misri;* that the

latter was an import article from Egypt, specimens of which, I regret to say, I was unable to procure.

Microrhynchus spinosus, Benth.—Native name *Chir-kah*.—This is a small shrub from one to two feet in height, with numerous intricately twisted branches, interlaced so as to give the shrub the form of a ball. It is apparently leafless, and very much resembles *Lactuca orientalis*, but has thicker and more fleshy branches without spines; both grow in the same stony gravel, especially on limestone débris. This plant yields a milky juice, which exudes from injury, and dries in small grayish-black pieces, irregular in form, the largest the size of a pea. This is collected and sold under the name of false *Anzérút*, or *Anzrúd*, and has the most nauseous and offensive odor of any substance that I have ever come across. The native who showed me this product said he knew the true *Anzérút*, or Sarcocolla drug, quite well; that it was collected from somewhat similar bushes by shaking them over a cloth, and that these bushes were common near Koin, Birjand, and Yezd, in Persia, and were called *Chir-kah* and *Shai-a-kah*.

A true pine resin, also called *Anzérút*, is imported into Meshad from India.

Delphinium Zalil, Aitch. and Hemsley, *nov. sp.*—This plant is found in great luxuriance at an altitude of 3,000 feet in the moister localities of the Badghis and Khorasán, and is called by the natives *Zalil*, also *Isparak*, *Isburg*, *Aswarg*. The flowers, which, when fresh, are of a brilliant yellow, are employed in native medicine as a tonic and alterative, but are usually exported from Persia and Afghanistan as a dyestuff.

Papaver somniferum, Linn.—The opium poppy is cultivated in Khorasán, where the inhabitants both eat and smoke it. The quantity produced is chiefly consumed in the country itself, a little being exported westwards through Persia, and some towards Turkistan. In Afghanistan it is but little cultivated, and scarcely used.

Merendera persica, Boiss.—This spring flower is extremely common throughout Afghanistan and Persia. The corms of this species, with their external coverings removed, were sold at Meshad as *Shambalit*, one of the kinds of *Hermodactylus*, and which may be occasionally mixed with the corms of *Colchicum speciosum*, Stev., also a common plant in those parts. This is exported from Persia to India by the Persian Gulf to Bombay, rarely through Afghanistan.

The *Surinján* of the Punjab, which may also be another form of the

Hermodactylus of the ancients, and which is imported into the Punjab from Kashmir, is without doubt the corms of *Colchicum luteum*, Baker. This is very common on the passes in Kashmir, extending as far west as the Murree Hills to Abbotabad, and has even been collected at as low an altitude as Lawrencepur. The corms of *Colchicum luteum* may be occasionally adulterated with those of *Marendera Aitchisonii*, Hook. fil., which I now believe is a variety of *M. persica*, and which is very common throughout the salt range extending to Kashmir.—*Phar. Jour. and Trans.*, Dec. 11, 1886, p. 465.

MINUTE OF THE COLLEGE.

PHILADELPHIA, December 27, 1886.

A stated meeting of the members of the College of Pharmacy was held this day at the usual hour, in the hall, Chas. Bullock presiding. Fourteen members present. The minute of the last regular meeting, September 27th, was read, accepted as a correct record, and adopted. The minutes of the Board of Trustees for the months of October, November and December, were read by the acting Secretary, and on motion, approved.

Under the consideration of general business, an interchange of views arose upon the propriety of a more strict application of the conditions imposed upon resigning members in Article XVI, Chapter 8, of the By-laws of the College. The article reads, in part, as follows: "No resignation shall be received from any active member of the College, unless the same be accompanied by a voucher that his certificate has been returned, or destroyed, and all arrearages paid."

Instances of non-compliance with these terms led to a generally expressed sense of the members that, hereafter resignations will be withheld from official action until satisfactorily endorsed by the Treasurer.

As a topic of common and increasing interest, the consideration of educational advancement, as indicated in the proceedings of the Inter-Colonial Pharmaceutical Conference, held at Melbourne, Australia, in October last, was brought to the attention of the members by Prof. Maisch. Reference was made to the practical operation of the two main points, or features, namely, that of "securing a uniform system and standard of education, throughout Britain and her Colonies," and of "making certificates of attestation interchangeable." A diversity of opinion was expressed upon the feasibility of including America in the application of such system. Some members viewed such as the probable purpose and object of the movement—others dissenting from this impression. It was thought, however, that a more explicit understanding of the whole subject would result from the comment and discussion, which it will receive in the columns of the various periodicals. One other important subject developes in the deliberations of the Conference, namely, the consider-

ation of the "duration, or period of apprenticeship," the disposition of all governing bodies, except upon the Continent, being to require *four* years of *actual* service and application, as the minimum term sufficient.

No other business being brought before the meeting, a motion of adjournment prevailed.

WILLIAM B. THOMPSON,
Secretary.

MINUTES OF THE PHARMACEUTICAL MEETING.

PHILADELPHIA, December 21, 1886.

The third of the present series of Pharmaceutical Meetings was held this day, Mr. Robert England being chosen chairman.

The minutes of the last meeting were read, and there being no corrections required, they were approved.

The actuary presented to the library from Dr. A. B. Lyons, the author, a treatise on pharmaceutical assaying, designed especially for the use of the student and of the practical pharmacist. The thanks of the College were directed to be returned by the registrar.

Specimens of the sands thrown up from the geysers during the earthquake near Charleston, S. C., in August last, were presented by Mr. G. J. Luhn. Handsome specimens of chrome iron ore, brought from Taxit, Syria, were presented to the cabinet.

Two varieties of fustic were presented by Mr. Palmer, chemist for J. M. Sharpless & Co. They are known as Tampico and Corinto, and show the coloring matter, a calcium salt, deposited in the cavities of the wood. The thanks of the meeting were tendered to the givers for these specimens.

Papers being called for, Mr. Meyers read one on the *sulphur industry of the west*, which elicited some conversation respecting the sulphur deposits of different countries. The paper was, on motion, referred to the committee on publication.

Mr. Bullock read a paper upon *artificial oil of wintergreen*, and exhibited the results of a series of experiments made by George W. Beringer, Ph. G. The paper was referred to the committee on publication.

Mr. Bullock also read a paper upon *oil of sassafras*. Prof. Trimble asked if any oil of camphor had been detected in any specimens, to which reply was made that it had not been so examined, but that it would be well to have such a test made. This paper was also referred to the publication committee. Prof. Trimble's remark gave rise to a query regarding the uses to which the oil of camphor is put, as there have been about 125,000 pounds imported into the country; but it seems that its use has not been traced thus far.

Mr. Joseph W. England read a paper on *subiodide of bismuth*, a preparation which has been growing into use for some time past, to be employed in place of iodoform, having similar remedial properties and being free from the disgusting odor of the latter. Prof. Maisch inquired if the yellow subiodide was a true iodide or a mixture of the subiodide with another salt. The reply was

that about 10 per cent. was subiodide. On motion the paper was referred to the publication committee.

The actuary read a short paper upon the *change of color noticed in a mixture* composed of syrup of wild cherry bark, syrup of squill, morphine acetate and sweet spirit of nitre.

After a short conversation the meeting, on motion, adjourned.

T. S. WIEGAND,
Registrar.

EDITORIAL DEPARTMENT.

Pharmaceutical Education.—Nearly twenty years ago the first practical steps for pharmaceutical legislation in the United States were inaugurated, through a resolution offered by Dr. Squibb before the American Pharmaceutical Association. The late John Milhau, who was then President of the Association, had previously interested himself in favor of such a measure, as far as the city and state of New York were concerned. In the following year, 1868, a report was made to the Association, giving all the laws relating to pharmacy, then on the statute books of the different States; and in 1869, the draft of a law was reported, and subsequently communicated to the governor and legislature of each state. This proposed law aimed in an indirect manner, to secure, aside from the requisite practical experience, the proper education of the young pharmacists. In the laws which have been enacted since, this last mentioned aim has been more or less lost sight of, even in those States where higher educational institutions are maintained, at which the expenses for tuition are of mere nominal amount. It is true, that some of the laws recognize directly the value of systematized education in addition to shop practice; but in no single instance is the former required. Modelled after the British law, but without the prerequisite of the latter—education prior to apprenticeship—our pharmacy laws are necessarily to that extent less efficient, than that of Great Britain.

It is but natural that the pharmacy acts in force in the different colonies of Great Britain should be framed after that of the mother country. In the Australian colonies, Tasmania began the regulation of the practice of pharmacy as early as 1842, when a board of medical examiners was created for the purpose of testing, by examination, the qualification of those intending to embark in business as a pharmaceutical chemist. The other colonies followed with enactments; but the pharmacy boards are composed of pharmacists, two of the Queensland Board being medical men, but registered pharmaceutical chemists of Great Britain, and in New South Wales the board is composed of seven pharmacists and two physicians. These boards are examiners, but they have encouraged the establishment of Colleges of Pharmacy, of which several are in existence. With the view of harmonizing pharmaceutical education in Australia, an intercolonial conference was held in Melbourne, October 27, 28 and 29, of 1886, at which representatives of the pharmaceutical societies and examining boards of the different colonies were present, namely: three from New South Wales, two each from New Zealand, South Australia, Tasmania and Victoria, and one from Queensland.

The deliberations of this conference, as published in the *Chemist and Druggist of Australia*, and in the *Australasian Journal of Pharmacy*, were characterized by the evident desire of elevating pharmacy, and placing it in all the colonies upon such a basis, that there shall be no essential difference in the qualifications exacted in each. These objects are to be accomplished, by insisting upon a good education *prior to apprenticeship*, upon an apprenticeship of four years upon a systematic course of study in the essential branches, and finally by written, oral and practical examinations. The delegates were unanimous on nearly all points, including the details, and appeared to have no doubt that the essential features of the plan would be adopted by the different legislatures. As soon as this is accomplished, the certificates of qualification will be mutually recognized, and it has been urged that they also be recognized in Great Britain; the hope was even expressed that they would ultimately be exchangeable with France and Germany. Although the colonies recognize the French diploma of "pharmacien" and the German certificate of "State's Examination," there is no likelihood of reciprocity being secured with the two countries named, or with any other of continental Europe, for many years to come; and even in Great Britain a modification of the Pharmacy Act seems to be necessary before the object sought can be attained. It is rather significant that in this particular respect no allusion was made to the reciprocity with other British colonies, or with Canada or the United States. As far as our country is concerned this is probably due to the heterogenous legislation, and the total absence of compulsory pharmaceutical education and of uniformity of qualification, demanded under our laws. For the present it seems more likely that proof of attendance at a full course in a reputable college in this country may be accepted as complying with the required course of study, than that American certificates of qualification issued under our pharmacy laws may be regarded as the equivalent of Australasian certificates.

In directing special attention to the proposed Intercolonial Pharmaceutical Council, we append here the resolutions adopted by the conference. They are as follows:

I. That a uniform system of education is desirable, such system to embrace—

(A) Preliminary Examination to include the same subjects as required by the Pharmaceutical Society of Great Britain, to be passed prior to apprenticeship; but if the candidate produces and lodges with the registrar a certificate, that he has at the matriculation examination by some university, college or school recognized by the Board, passed in the above or corresponding subjects, he shall not be required to pass this examination.

(B) Apprenticeship of four years.

(C) Course of study, based upon the course adopted by the Pharmaceutical Society of Great Britain.

(D) Examinations, to be conducted by examiners appointed by boards, councils, or governing body.

(1) The mode of conducting examinations to be both written and oral in every subject, the oral to be at the discretion of the various boards and societies.

All candidates for the qualifying examination shall have reached the full age of twenty-one years.

(2) The subjects of examinations to embrace Botany, Materia Medica, Chemistry, and Practical Chemistry, to be conducted, as far as practicable, in conformity with the practice in Great Britain; and Practical Pharmacy conducted as in Victoria, each candidate to obtain not less than 50 per cent. in dispensing.

II. That uniformity in Australasian Pharmaceutical Legislation is desirable.

That in the interpretation clause of the various acts of the various colonies the name of the colony be omitted.

That clause 10 of the amended Pharmacy Act of Victoria, or words of similar import be adopted by this conference. [1]

III. That uniformity in the laws relating to the sale and use of poisons and the regulations for their custody is desirable, where practicable.

That a Poisons Bill be drafted by the various pharmaceutical bodies of Australasia, and circulated in all the colonies for discussion, and on its adoption that steps be taken to obtain its further adoption by the respective legislatures.

IV. That, on adopting and giving effect to resolution I., the Examination Certificates shall be recognized by the Governing Bodies of the various colonies.

V. That it be a request to the Registrars of the Australasian Pharmacy Boards or Councils to forward copies of the examination papers to each board.

VI. That copies of the resolutions adopted by this Conference be forwarded to the Colonial Secretaries of each of the colonies here represented, with a request that legislative power be given effect to in accordance with these resolutions.

VII. That the results of this Conference be transmitted to the Pharmaceutical Society of Great Britain with a request that interchange of certificates be considered.

VIII. That it is most desirable that an Intercolonial Pharmaceutical Council should be established, such Council to visit and hold meetings in rotation in the various colonies of Australasia to discuss and consider questions relating to intercolonial pharmaceutical subjects.

IX. That the rapid increase in the trade of proprietary medicines and secret nostrums is antagonistic to the true interest of pharmacy.

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

Drugs and Digestion. By Robert G. Eccles, M. D., 12mo.. pp. 26. Reprint from the New York *Medical Journal.*

Sur les Urines sucrées, (on urines containing sugar).

Sur une forme rare de graviers d'oxalate de chaux, (on a rare form of gravel of calcium oxalate.)

These two essays are by Dr. C. Méhu, pharmacist of the Paris Charité, and are reprints from Annales des Maladies des Organes génito-urinaires.

1 The clause referred to is as follows—The Board shall from time to time cause the names of all persons certified by the Board to be registered.

Annual Report of the Commissioner of Pensions, for the year ended June 30, 1886, Washington, D. C., 8vo., pp. 70.

The Physician's Visiting List for 1887. Philadelphia. P. Blakiston & Co.

This is the thirty-sixth year of the publication of this visiting list; it is issued in different sizes and styles varying in price from $1 to $3.

Manual for the use of Boards of Health of Massachusetts, containing the statutes relating to the public health and the decisions of the Supreme Court of Massachusetts relating to the same. Prepared by direction of the State Board of Health, Boston: Wight & Potter, State Printers, 1886. 8vo. pp. 117.

OBITUARY.

Julius Wilhelm Albert Wigand, Ph. D., Professor of Botany at the University of Marburg, and director of the botanical garden and of the pharmacognostic institute at that university, died in Marburg, October 22, 1886, aged 65 years, 6 months. He was the second son of Dr. Frederick Wigand, apothecary in Treysa, Hesse-Cassel, was educated at the classical school in Marburg, studied at the university in the same city natural sciences, mathematics and philology, and graduated there in 1846. After continuing his studies in Berlin and under Schleiden in Jena, he qualified in Marburg as teacher (Privatdocent) of botany, August 29, 1849, became extraordinary professor March 27, 1851, and after Wenderoth's death, ordinary professor of botany December 11, 1861. Aside from his numerous contributions to botanical science, which are scattered in various journals, he published, 1874–77, a work on Darwinism in three volumes; also a valuable work on Pharmacognosy and a Flora of Hessia (Electorate) both of which passed through several editions.

Louis Mialhe, formerly Professor on the Paris Ecole de Médecine, died in Paris, November 1, 1886, in the 80th year of his age. The deceased was in business in Paris as a pharmacist, and had also studied medicine. He wrote numerous essays on pharmaceutical and toxicological subjects, and was one of the editors of the Journal de Pharmacie et de Chimie. He was one of the honorary members of the Philadelphia College of Pharmacy.

The following graduates of this college died recently:

David L. Stackhouse, class 1854, died in Philadelphia, November 25, 1886, in the 54th year of his age. He was born in Bucks Co., Pa., learned the apothecary business with Thos. J. Husband, and subsequently went into business at Eighth and Green Streets.

Joseph Bloomfield Wetherill, class 1857, a native of Philadelphia, died in New York, December 6, 1886. After learning the drug business with Thos. P. James and conducting for some years a drug store in Memphis, Tenn., he went to New York to study theology, was afterwards connected with Episcopal Churches in Rome, Italy, and Newark, N. J., and with St. Paul's Church in New York, and finally was rector of St. Ambrose Church in that city.

Thomas R. Coombe, class 1859, of Chester, Pa., was an apprentice under Jas. N. Marks, and afterwards was engaged in business in West Philadelphia. Several years ago he disposed of his store and removed to Edgewater Park, N. J., where he died December 11, 1886.

CLASS OF THE PHILA. COLLEGE OF PHARMACY,

SIXTY-SIXTH ANNUAL SESSION, 1886-1887.

JUNIOR CLASS.

Matriculates.	*Town.*	*State.*	*Preceptor.*
Allwine, Jr., John, (Special)			
Amerman, Ella,	Danville,	Pa.	S. Hayhurst, M. D.
Angeny, Joseph Sleifer,	Doylestown,	Pa.	L. Gerhart.
Bacon, Francis Llewellyn,	Germantown,	Pa.	R. Shoemaker & Co.
Bacon, William Warder,	Germantown,	Pa.	R. Shoemaker & Co.
Baird, John,	Philada.,	Pa.	H. B. Taylor, Ph. G.
Baird, Robert,	Amsterdam,	N. Y.	C. G. A. Loder.
Barrett, Charles Llewellyn,	Chester Co.,	Pa.	D. S. Jones.
Barrett, Walter Raphael,	Shawnee,	Ohio.	Chappalear & Bro.
Batdorff, Henry James,	Lykens,	Pa.	Brallier & Co.
Bauer, Louis Demmé,	Philada.,	Pa.	L. G. Bauer, M. D.
Bayha, George Eugene,	Wheeling,	W. Va.	G. R. Scheehle.
Beale, Benjamin,	Philada.,	Pa.	Edmund Beale, M. D.
Beatty, Eugene LaVere,	Philada.,	Pa.	W. R. Warner & Co.
Beckwith, James Webb,	Elmira,	N. Y.	Kennedy & Burke.
Bell, James Edgar Stevenson,	Los Angeles,	Cal.	Davis & Whisler.
Bentley, David Fuller,	Haddonfield,	N. J.	R. Shoemaker & Co.
Berkau, Theo. Her. Arlington,	Philada.,	Pa.	Dr. John Tomlinson.
Bickel, Milton Henry,	Reading,	Pa.	Drueding Bros.
Bickel, Harry Lee,	Felton,	Del.	M. M. Stevenson.
Bippus, Charles William,	Bellaire,	Ohio.	C. E. Hewitt & Co.
Birch, Harry Reese,	Philada.,	Pa.	Bullock & Crenshaw.
Blackburn, Robert Perry,	Lock Haven,	Pa.	T. C. Felton & Co.
Blouch, Charles Henry,	Lebanon,	Pa.	Edward R. Burdick.
Bond. Ira Linton,	Tamaqua,	Pa.	John T. Bond.
Bonewitz. Orr Ray,	Van Wert,	Ohio.	F. Jacoby, Jr.
Bowen, Charles Alfred,	Bordentown,	N. J.	Wilson Cutter.
Bowers, Charles Edward,	Middletown,	Pa.	J. W. Rewalt.
Breidenbach, Charles Henry,	Dayton,	Ohio.	W. A. Burns, M. D.
Brennan, John Thomas,	Philada.,	Pa.	J. Howard Evans, M.D
Brensinger, Ellen C., M. D.,	Philada.,	Pa.	S. Hayhurst, M. D.
Brick, Harry Walter,	Philada.,	Pa.	Bullock & Crenshaw.
Brown, Charles James,	Dubuque,	Iowa.	W. H. Torbert.
Buchanan, Frank,	Crum Lynne,	Pa.	Chas. H. Roberts.
Butters, Charles Hayes,	Titusville,	Pa.	T. W. Reuting, Ph. G.
Cahill, Frank Joseph,	Trenton,	N. J.	J. E. Cahill.
Caldwell, Florence Moore,	Philada.,	Pa.	L. W. Caldwell, M. D.
Cameron, Harrie Ross,	Zion,	Md.	F. P. Lins, Ph. G.
Cannon, Charles Walton,	Bridgeville,	Del.	R. W. Cannon.
Carman, Frank Hamilton,	Vincentown,	N. J.	W. B. Christine, M. D.
Cartwright, Benjamin Franklin,	Port Carbon,	Pa.	W. Delker, M. D.
Cassidy, John Francis,	Philada.,	Pa.	W. H. Pile & Son.
Castle, Abraham Lincoln,	Chester,	Pa.	A. S. Buchanan.
Charles, John Andrew,	Lancaster,	Pa.	S. B. McCreery, M. D.
Christ, Frank Eugene,	Philada.,	Pa.	F. R. Gosling, Ph. G.

Matriculates.	*Town.*	*State.*	*Preceptor.*
Clapham, Benson Grant,	Mifflinburg,	Pa.	H. C. Clapham.
Clark, Gilbert F.,	Lansdale,	Pa.	F. G. Bigony, M. D.
Coale, Arthur Newton,	Havre de Grace,	Md.	E. A. Zeitler.
Codville, William Lowther,	Philada.,	Pa.	A. Tatem.
Coleman, Fred. Frelinghuysen,	Asbury Park,	N. J.	J. B. Moore, Ph. G.
Coley, Lemuel Belah,	Alexander City,	Ala.	A. J. Coley, M. D.
Collins, Thomas James,	South Oil City,	Pa.	Bullock & Crenshaw.
Cope, Frank Henry,	Philada.,	Pa.	Dr. William Auffurth.
Copeland, George Hogan,	Renovo,	Pa.	Hall & Brothers.
Cooper, Percival Valentine,	Media,	Pa.	W. E. Dickeson.
Crass, John Henry,	Bridgeton,	N. J.	C. H. Clark, Ph. G.
Crawford, Oscar,	Nazareth,	Pa.	Walter Crawford, Ph.G
Cremer, Jacob Gruel,	Chambersburg,	Pa.	W.W. Moorhead, Ph.G
Crumbie, George Joseph,	Philada.,	Pa.	D. Milligan, Ph. G.
Crutcher, William,	Nicholasville,	Ky.	J. Oxley, Ph.G.
Culin, Walter,	Moorestown,	N. J.	W. S. Reeve.
Dalton, Joseph Edwin,	Upland,	Pa.	O. P. Hooper.
Davenport, Benjamin Lincoln,	Shenandoah,	Pa.	R. England.
Davies, William Owen,	Slatington,	Pa.	J. A. Wiegner,
Davis, Clayton Erwin,	Florence,	Mass.	N. A. Davis.
Davis, Edward,	Minersville,	Pa.	D. R. Davis.
DeHaven, Samuel Robert,	Toledo,	Ohio.	A. Hertzman.
Demaree, Thomas Elliott,	Newport,	Pa.	W. C. Byers.
Demoville, James Louis,	Nashville,	Tenn.	Demoville & Co.
Devine, Oliver Crawford,	Philada.,	Pa.	Dr. McVicker.
Donaldson, Thomas,	Wilmington,	Del.	N. B. Danforth; Ph. G.
Dooling, Lewis.	Millville,	N. J.	Dr. T. C. Wheaton.
DuBois, Samuel Conier,	Philada.,	Pa.	J. F. O. Agthe.
Dyer, Charles Ellsworth,	Topeka,	Kan.	J. K. Jones.
Earle, George Wetherill, Jr.,	Wynnewood,	Pa.	E. C. Jones & Co.
Eisenhart, Edwin Kamerer,	Bingen,	Pa.	R. F. Babp.
Elfreth, Jr., Caleb Pierce,	Philada.,	Pa.	C. P. Elfreth.
Escott, Louis William,	Grand Rapids,	Mich.	E. B. Escott, dec'd.
Evans, William,	Philada.,	Pa.	A. L. Lamb.
Faries, Joseph Benjamin,	Smyrna,	Del.	S. P. Wright, Ph. G.
Feather, John Frank,	West Liberty,	Ohio.	R. M. Fulwider.
Fegley, Oscar George,	Pottsville,	Pa.	Dr. J. S. Ward.
Fink, Allen Jacob,	Hamburg,	Pa.	J. H. Stein, Ph. G.
Focht, Jacob Mauger,	Pottstown,	Pa.	H. B. Lippincott.
Fountain, Edward Jones,	Bryan,	Texas.	Stuart & Co.
Frantz, Will Lintner,	Lancaster,	Pa.	G. W. Hull.
Franz, Frederick William,	Sioux City,	Iowa.	F. Hansen.
Freeman, Clayton Lewis,	Freemansburg,	Pa.	O. J. Freeman.
French, Francis Freas,	Philada.,	Pa.	W. H. Koons, Ph. G.
Fretz, Mahlon Barnes,	Chalfonte,	Pa.	J. P. Slaughter.
Frizzell, George,	Henry Clay,	Del.	W. J. Stoner.
Froelich, Walter Scott,	York,	Pa.	W. H. Lewellyn, Ph.G
Fruit, Will,	Hazleton,	Pa.	McClure & Co.
Furman, Frank Richard,	Hazleton,	Pa.	McNair & Hoagland.
Gallaher, Charles Sumner,	Neillsville,	Wis.	C. C. Sniteman, Ph. G.
Gardner, Orpheus Eugene.	York,	Pa.	
Gilbert, Thomas Henry,	Pulaski,	Tenn.	Sumter & Son.
Gill, Charles Alfred,	Hulmeville,	Pa.	Omar H. Musser, Ph.G.
Good, Wm. Franklin Preston,	Allentown,	Pa.	Hartzell & Co.
Goodyear, Andrew Kerr,	Philada.,	Pa.	P. Niskey.
Gould, Harry Zinn,	Carlisle,	Pa.	S. A. Haverstick.
Gracey, Archibald Alexander,	Philada.,	Pa.	J. E. Loughlin.
Graham, John Livingston,	Morton,	Pa.	E. C. Jones & Co.
Green, Philip Henry,	Reading	Pa.	H. A. Borell, Ph. G.

Matriculates.	*Town.*	*State.*	*Preceptor.*
Greenfield, Oliver Roat,	Wilmington,	Del.	H. K. Watson.
Grossé, Gottlieb Matthew,	Cleveland,	Ohio.	W. F. Grossé.
Haak, Harry Clapp,	Pine Grove,	Pa.	J. B. Raser, Ph. G.
Hallowell, Bruce Clyde,	Frankford,	Pa.	G. S. R. Wright.
Hanson, Arthur Edward,	Philada.,	Pa.	
Harm, William John,	Columbia,	Pa.	Newbold Bros.
Hartel, Charles J. W.,	Washington,	D. C.	Camp's Pharmacy.
Hauck, Samuel Light,	Lebanon,	Pa.	E. R. Burdick.
Haussmann, Fred. William,	Philada.,	Pa.	Chris. Weiss.
Hazel, Thomas Harold,	Cressona,	Pa.	J. F. Lautenbacher.
Hebsacker, William Frederic,	Philada.,	Pa.	J. Wendel.
Heffley, Harry Baker,	Somerset,	Pa.	E. & G. A. Früh.
Hennessy, Sherman Francis,	Pottsville,	Pa.	C. H. Wagner.
Henry, Samuel Clement,	Jenkintown,	Pa.	J. W. Ridpath.
Hermany, Horace David,	Mahanoy City,	Pa.	D. P. Hermany.
Hess, James Monroe,	Bethlehem,	Pa.	H. A. Burkhart.
Hibshman, Paul Robert,	Myerstown,	Pa.	A. S. Erney, M. D.
Hilliard, George B.,	Ackermanville,	Pa.	W. J. McClean.
Hinkson, William Elwood,	Chester,	Pa.	Charles E. Davis.
Hoch, Aquila,	Bushkill Centre,	Pa.	M. M. Buss, Ph. G.
Horn, Henry Morford,	Lone Pine,	Pa.	Wm. S. Mills, M. D.
Houck, Paul Winters,	Lebanon,	Pa.	F. Matthes, Ph. G.
Hume, Ward Dutcher,	Minneapolis,	Pa.	Robert McNeil.
Humma, Henry John,	Reading,	Pa.	Dr. C. S. Ermentrout.
Hunt, Gideon Shoop,	Danville,	Pa.	R. D. Magill.
Iobst, Frederick John,	Emaus,	Pa.	N. H. Kamerer.
Jacob, Charles Pim,	Limerick, Ireland.		G. C. Webster, Ph. G.
Jacobs, Eugene Jacob,	Atlanta.	Ga.	Joe Jacobs, Ph. G.
Jacobs, Oliver Barron,	Ridgeville,	Del.	R. W. Cannon.
Johnson, Claude Grant,	Cumberland,	Md.	H. Lamey.
Johnson, Frank R.,	Chester,	Pa.	G. Banks Wilson.
Johnson, Frederick Leighton,	Cape May,	N. J.	H. A. Kennedy.
Johnson, Harry Eneu,	Philada.,	Pa.	Special.
Johnson, Jr., Joseph,	Trenton,	N. J.	A. G. Holcomb.
Johnson, Louis William,	Trenton,	N. J.	Rickey & Cook.
Johnson, Wm. Arthur Sterling,	Charlottstown,	Canada,	Apothecaries Hall Co.
Johnson, William Britton,	Philada.,	Pa.	Bullock & Crenshaw.
Johnson, William H.,	Philada.,	Pa.	Special.
Jones, Lysander Mann,	Scranton,	Pa.	J. J. Davis, Ph. G.
Jones, Peter Laurence,	Jamestown,	N. Y.	Axel F. Johnson.
Jones, William Carrell,	New Egypt,	N. J.	J. Hurley Compton.
Jones, William Lincoln,	Catasauqua,	Pa.	W. Heckenberger.
Jump, Robert Burton,	Dover,	Del.	S. D. Marshall, M. D.
Kahnweiler, Levi,	Harrisburg,	Pa.	W. H. Egle & Co.
Kalteyer, William,	San Antonio,	Texas.	G. H. Kalteyer.
Kappes, Frederick Franklin,	Zanesville,	Ohio.	Nye Bros.
Keefer, Charles DeWalt,	Chambersburg,	Pa.	C. H. Cressler.
Keller, Augustus Herman,	Philada.,	Pa.	A. G. Keller.
Kennedy, Albert Dennis,	Philada.,	Pa.	S. H. Shingle.
Kern, Emil Julius,	Philada.,	Pa.	V. H. Smith & Co.
Kern, Morris Benjamin,	Tamaqua,	Pa.	H. L. Barber.
Kiger, Harry Stiles.	Wilmington,	Del.	H. C. Lintner.
Kitchen, Harry Allen,	Warren,	Pa.	Johnson & Siegfried.
Klopp, Peter Paul,	N. Heidleberg,	Pa.	N. Davis.
Koch, Eugene,	Philada.,	Pa.	L. Koch.
Kraemer, Henry,	Philada.,	Pa.	C. B. Lowe.
Krider, Richard C.,	Philada.,	Pa.	Stryker & Ogden.
Lammer, Henry Bruno,	Philada.,	Pa.	Bullock & Crenshaw.
Latta, James,	Wilson.	Kan.	D. W. Lillie.

Matriculates.	*Town.*	*State.*	*Preceptor*
Leach, Albert Edwin,	Lyons,	N. Y.	W. A. Hersey.
Lesher, Edwin Charles,	Kutztown,	Pa.	A. M. Steinmetz.
Lewis, Griffith Robert,	Catasauqua,	Pa.	E. D. Boyer, Ph. G.
Lewis, Lilbourn Galatin,	New Madrid,	Mo.	
Lippen, Harry,	Salem,	N. J.	H. M. Levering.
Lippincott, Ahab Haines,	Camden,	N. J.	E. S. Powers.
Livezey, John Bennett,	Doylestown,	Pa.	G. T. Harvey, M. D.
Livingood, Albert John,	Reading,	Pa.	John B. Raser, Ph. G.
Loucks, Charles Edward,	Ashland,	Ohio.	G. P. Harley.
Lupus, Herman Earnest,	Philada.,	Pa.	A. H. Weber.
Lyman, Robert Huntington,	Doylestown,	Pa.	Dr. Geo. T. Harvey.
Lynch, Albert James.	Woodstown,	Canada,	Garden Bros.
MacCollin, William Henry,	Philada.,	Pa.	Martin & Sommers.
MacCouch, Sam'l. Emlen,	Malvern	Pa.	Geo. R. Walton.
MacPherson, Frank Street,	Trenton,	N. J.	L. H. Street.
McCandless, Edward Sloan,	Philada.,	Pa.	W. H. Carslake.
McClellan, Leslie Corwin,	Utica,	Ohio.	
McClure, Berthier,	Milton,	Pa.	
McCouch, John,	Philada.,	Pa.	
McDowell, Charlie Hunt,	Lambertville,	N. J.	S. W. Cochran.
McIntosh, John R.,	Galion,	Ohio.	B. N. Bethel.
McVay, James Patrick,	Philada.,	Pa.	F. E. Morgan.
Macartney, Frank Hamilton,	Berwyck,	Pa.	Grove & Kesner.
Madeira, Robt. Wesley,	Shoemakerville,	Pa.	J. B. Raser, Ph. G.
Masholder, Harry Jacob,	Philada.,	Pa.	V. H. Smith & Co.
Meissner, Frederick William,	Laporte,	Ind.	Eliel Sons.
Meyers, Harry Joseph,	Bethlehem,	Pa.	E. T. Meyers.
Miles, Charles John Austen,	Manchester,	N. J.	R. W. Cuthbert, Ph. G.
Millett, Martin Edward,	Philada.,	Pa.	Bullock & Crenshaw.
Moffett, John.	Philada.,	Pa.	John Moffett.
Moor, Jr., Edward,	Media,	Pa.	R. T. Grime.
Moore, Frank Guthrie,	Cochranstown,	Pa.	
Moore, Milton,	Terre Haute,	Ind.	Bullock & Crenshaw.
Morgan, George Irving,	Lynn,	Mass.	F. E. Morgan.
Morrison, John Lewis Dale,	Camden,	N. J.	H. W. Miller.
Moss, William,	Akron,	Ohio.	Case & Schambs.
Myers, Harry Coffinberry,	Cleveland,	Ohio.	Benton Myers & Co.
Muir, Clarence Frick,	Lock Haven,	Pa.	E. S. Muir.
Mumma, Frank Gerson,	Mechanicsburg,	Pa.	Dr. J. H. Boyer.
Münster, Wm. Christian,	Evansville,	Ind.	W. F. Spencer.
Murray, Harry Louis,	McAlistersville,	Pa.	J. C. Weidman.
Murray, Thomas Francis,	Bryn Mawr,	Pa.	S. F. Stadelman.
Musgrave, Aaron Wallace,	Wellversville,	Pa.	L. E. Sayre & Co.
Neill, Charles Bodine,	Woodbury	N. J.	A. S. Marshall, Ph. G.
Neiffer, Solomon Harvey,	Wiconisco,	Pa.	C. D. Christman, M.D.
Neville, William,	Conshohocken,	Pa.	Jas. W. Harry.
Nichols, John Baugh,	Philada.,	Pa.	W. R. Warner & Co.
Nolte, Henry Augustus Selle,	Swedesboro.	N. J.	C. C. Hughes.
Nowell, Edward Hewitt,	Ravenswood,	W. Va.	J. W. Denoon.
Oerter, Albert Eugene,	Bethlehem,	Pa.	Dr. Julian Fajans.
Offutt, Albert Lee,	Paris.	Ky.	H. B. Spackman.
Ogden, Charles Sheppard,	Camden,	N. J.	W. F. Richards, Ph.G.
Orr, James Parson,	Philada.,	Pa.	Geo. Holland.
Osborn, Daniel Cargill,	Starrucca,	Pa.	J. E. Farrell & Co.
Outcalt, Richard Stultz,	Hightstown,	N. J.	H. G. Roop.
Outen, Albert Petit,	Philada.,	Pa.	W. R. Warner & Co.
Palen, Joseph Alphonse,	Dubuque,	Iowa.	G. F. Thorman.
Peters, George Fegley,	Mauch Chunk,	Pa.	Joseph Lacier.
Pfund, Harry,	Philada.,	Pa.	J. A. Martin, Ph. G.

Matriculates.	*Town.*	*State.*	*Preceptor.*
Pickett, Charles Torbert,	New Hope,	Pa.	F. W. Throp.
Pierce, William Abner,	West Chester,	Pa.	Thos. G. Pierce.
Poppenhusen, H. Aug. Chas. Jr.,	Washington,	Mo.	C. Werckshagen.
Pringle, Jr., James Maxwell,	Charleston,	S. C.	L. A. Podolski.
Pryor, Wm. Brooks Thomas,	Langhorne,	Pa.	Dr. P. M. Minster.
Qualman, Chas. Christopher,	Peoria,	Ill.	W. M. Benton, Ph. G.
Quay, Frank Oscar,	Harrisburg,	Pa.	A. & F. Green.
Quigley, Richard Lucian,	York,	Pa.	T. B. L. Quigley.
Rabenau, John Herman,	Pottsville,	Pa.	H. Rabenau.
Ratcliff, William A. Walter,	Covington,	Ohio.	F. Alden Tifft, Ph. G.
Rawling, Wilbur Fish,	Dover,	Del.	Givin & Co.
Read, Harry,	Philada.,	Pa.	
Reck, Charles Lincoln,	Greenville,	Ohio.	
Reed, Howard,	Doylestown,	Pa.	C. A. Weidemann, Ph. G., M.D.
Reig, Eugene George,	Warren,	Pa.	L. G. Moyer.
Reith, Emil,	Philada.,	Pa.	C. Petzelt.
Richard, Howard Newton,	Trenton,	N. J.	Irving W. Kelly.
Roberts, Lee,	Cambridge,	Md.	T. H. Williams, M. D.
Roehrig, Albert Henry,	Pottsville,	Pa.	G. F. Roehrig.
Rogers, Harry Wheaton,	Haddonfield,	N. J.	R. Willard.
Rohm, Peter Simon,	Easton,	Pa.	C. Jacoby.
Rossberg, Gustave Adolph,	La Crosse,	Wis.	Weston & Simon.
Rosenkranz, Cyrill Depue,	Fairdale,	Pa.	J. T. Shinn.
Roth, Sam'l George Jeremiah,	Laury's,	Pa.	A. Weber.
Rourke, Michael,	Reading,	Pa.	J. A. Gingrich,
Ryan, David Stephen,	Scranton,	Pa.	Dr. Douglass.
Sangston, James Allen,	Wilmington,	Del.	G. Williams.
Schimmell, John,	Trenton,	N. J.	G. A. Walker.
Schlaepfer, August James,	Evansville,	Ind.	H. J. Schlaepfer.
Schlesselman, John Henry,	Philada.,	Pa.	C. H. Hæntze.
Schlief, William, Jr.,	Milwaukee,	Wis.	Aschenbach & Miller.
Schminky, Allen Beecher,	Lykens,	Pa.	A. G. Stanbury.
Schmitt, Herman Thad. Stevens,	Philada.,	Pa.	V. H. Smith & Co.
Schneider, John,	Philada.,	Pa.	M. D. Streeter, Ph. G.
Schroeter, Herman John M.,	Watertown,	Wis.	R. H. Brennecke.
Seasholtz, John Clay,	Sunbury,	Pa.	Dr. Butt.
Seiffert, John Henry,	York,	Pa.	Wm. Smith & Co.
Shugar, William Grant,	Lebanon,	Pa.	W. L. Deninger.
Simons, Robert,	Philada.,	Pa.	W. R. Warner & Co.
Sitgreaves, Wesley Cline,	Vincentown,	N. J.	F. Sanderson.
Skeath, George Washington,	Mahanoy City,	Pa.	A. A. Weber.
Smith, Howard Metancthon,	Scranton,	Pa.	W. J. Pechin.
Smith, Frank H.,	Quakertown,	Pa.	S. Penrose, dec'd.
Smythe, Edward Stanhope,	Bryan,	Texas.	Dr. Smythe.
Snyder, Henry Nissley,	Lancaster,	Pa.	C. A. Heinitsh.
Snyder, Howard Grant,	Lancaster,	Pa.	B. F. Shell, M. D.
Sonntag, Maximilian,	Philada.,	Pa.,	W. K. Mattern, M. D.
Southall, Charles Morton,	Clarkson,	Tenn.	Owen Moore.
Spear, Oscar Crow,	Wilmington,	Del.	Dr. J. V. Blackson.
Speer, James Francis,	Shippensburg,	Pa.	Philada. Hospital.
Stengelin, William,	Easton,	Pa.	H. J. Odenwelder.
Strowbridge, George Henry,	Portland,	Oregon.	Plummer & Byerly.
Stone, Mims Baker,	Birmingham,	Ala.	Amzi Godden.
Stouch, Herbert Julius,	York.	Pa.	W. Ranstead Jones.
Stratton, Charles Clark,	Woodstown,	N. J.	Borton & Andrews.
Stunkle, John Louis,	Brownstown,	Ind.	Joseph A. Stillwell.
Supplee. Isaac Morris,	Conshohocken,	Pa.	Dr. Aikens.
Schwartz, Charles Michael,	Hughsville,	Pa.	J. K. Swartz.
Swisher, David F.,	Williamsport,	Pa.	B. A. Hertsch,

Matriculates.	*Town.*	*State.*	*Preceptor.*
Taylor, Thomas Clarkson,	Wilmington,	Del.	P. H. Wood.
Tennant, George Chester,	Vineland,	N. J.	Fred Rapp.
Terry, Ion Ellsworth,	Lancaster,	Pa.	H. C. Archibald, M. D.
Thompson, Herbert Moodie,	Thompsontown,	Pa.	Fred Rapp.
Thornton, Edward Quin,	Greensboro,	Ala.	A. Stollenwerck & Son.
Toland, Arthur D.,	Philada.,	Pa.	H. G. Shinn, Ph. G.
Twitchell, Selden,	Philada.,	Pa.	Special Student.
Tyler, Thomas VanDyke,	Laramie,	Wy. Ty.	H. S. Bartlett.
Uller, Emil Joseph,	Titusville,	Pa.	L. F. Segrest
Van Dyke, William Clinton,	Van Dyke,	Pa.	F. S. Keet.
Wagner, Robert Sidney,	Hazleton,	Pa.	J. A. Jeffries.
Waldenberger, Lewis,	Manayunk,	Pa.	M. A. Hull.
Wallis, Frank James,	Philada.,	Pa.	J. M. Wallis.
Walls, Frank,	Milton,	Del.	A. Nebeker, M. D.
Walton, Lucius L.,	Clinton,	N. J.	Justice L. Hill.
Ward, Percy Hall,	Crisfield,	Md.	C. B. Hunterson.
Warner, Edward Evans,	Philada.,	Pa.	E. B. Warner, M. D.
Wedemeyer, Frederick George,	Hanover, Germany.		E. W. Herrmann.
Weida, Charles Benjamin,	Allentown,	Pa.	C. H. Hæntze.
Weiser, Frank Resler,	Millersburg,	Pa.	J. E. Lehman.
Whittaker, William Hubert,	Dover,	Del.	W. E. Knowles.
White, Robert Walter,	Chambersburg,	Pa.	Charles E. Meyncke.
White, James Wesley,	Point Pleasant,	Pa.	Dr. Benjamin.
Williams, Harry,	Laurel,	Del.	W. J. Hitch.
Williams, William John,	Plymouth,	Pa.	Reese D. Williams.
Williamson, James Strickland,	Harrisburg,	Pa.	Dr. Theodore Jacobs.
Witzell, Joseph Richard,	Tacony, Philada.,	Pa.	Fisher's Pharmacy.
Wolcott, Abraham Lincoln,	Toms River,	N. Y.	Dr. Connel.
Wolf, Fredrick Joseph,	Philada.,	Pa.	R. Shoemaker & Co.
Wolf, Joseph Franklin,	Glassboro,	N. J.	White & Bro.
Woodruff, John Stewart,	Bridgeton,	N. J.	H. F. Seeley.
Woolcock, William,	Mahanoy City,	Pa.	W. D. Reynolds.
Wright, John Armstrong,	Philada.,	Pa.	A. W. Wright & Co.
Yale, Ellsworth William,	Allentown,	Pa.	H. E. Peters.
Yohn, Frank Jerrold,	Pottstown,	Pa.	F. J. Hoskinson.
Young, Charles Cooper,	Beverly,	N. J.	J. E. Himmelwright.
Young, Charles Henry,	Trenton,	N. J.	C. M. Forney.
Zane, James Stewart,	Glassboro,	N. J.	Dr. Souder.

SENIOR CLASS.

Name.	*Town.*	*State.*	*Preceptor.*
Allen, David Roberts,	Paris,	Ky.	C. G. Webster.
Anspach, Paul Bucher,	Easton,	Pa.	Weaver & Hohl.
Ashton, Charles Butterworth,	Norristown,	Pa.	Wm. Stahler.
Backenstoe, Harvey Franklin,	Union Deposit,	Pa.	W. Ranstead Jones.
Baer, Jacob Michael,	Hanover,	Pa.	J. T. Shinn. Ph. G.
Balbeirnie, Harold Hubert,	Philada.,	Pa.	Wardle Ellis.
Baldauf, Julius L.,	Henderson,	Ky.	J. A. Flexner
Barnes, Frank Albert,	Philada.,	Pa.	Dr. Jno. Marshall.
Baum, William Louis,	Morris,	Ills.	Dr. C. E. Clacius.
Bear, John H.,	Mt. Joy,	Pa.	E. B. Garrigues & Co.
Beck, Addison Lloyd,	Sharon,	Pa.	
Beckler, Warren B.,		Maine,	A. T. Pollard & Co.
Bender, William Piper, Jr.,	Camden,	N. J.	J. R. Angney, M.D.
Benerman, Alan Herbert,	Philada.,	Pa.	
Benner, Isaac,	Philada.,	Pa.	O. H. Sterner.
Bennum, Charles Henry,	Georgetown,	Del.	Harry Swain.
Bernardy, Emile Seraphin,	Philada.,	Pa.	A. T. Pollard & Co.
Beshore, Ellsworth Smith,	Bethel,	Pa.	J. M. Cunningham.
Bishop, Samuel Walter,	Beverly,	N. J.	H. C. VanMeter.
Black, Charles Edgar,	New Carlisle,	Ohio.	G. B. Evans.
Blomer, Jr., George Davis,	Philada.,	Pa.	G. D. Blomer, M.D.
Bondurant, Chas. Scott,	St. Louis,	Mo.	F. X. Crawley.
Bogart, Charles Mount,	South Amboy,	N. J.	G. W. Jacques.
Bowker, Frank,			H. M. Campbell.
Boyd, Charles Ducharme,	Easton.	Pa.	P. F. Brakely, Ph.G.
Brandt, Irvin Jacob,	Reading,	Pa.	W. J. Shaeffer.
Breneiser, Edgar,	Reading,	Pa.	J. H. Stein.
Brewer, William,	Woodbury,	N. J.	J. W. Merritt, Ph.G.
Brooks, William Dodge,	Memphis,	Tenn.	J. S. Robinson, Ph.G.
Brown, Frederick Kendall,	Seaford,	Del.	A. W Duvall, Ph.G., M.D.
Brownley, Charles Jackson,	Portsmouth,	Va.	Dr. W. O. Higgate.
Bucholz, Wm. MacGilvray,	Sharon,	Pa.	W. Weber.
Burgess, Milton S.,	Cambridge,	Ohio.	C. L. Wall & Co.
Burk, Alfred Gray,	Flemington,	N. J.	E. C. Vogelbach.
Burnett, James Howard,	Hackensack,	N. J.	L. B. Hirst.
Burton, Robert Jump,	Dover,	Del.	T. C. Tomlinson.
Butts, Simon Mark,	Gettysburg,	Ohio.	T. A. Wormley & Son.
Campbell, William Henry,	Philada.,	Pa.	F. Jacoby, Jr.
Carroll, Sherman Lincoln,	Philada.,	Pa.	P. G. A. Weber.
Cassaday, Orlin Ulysses,	Alliance,	Ohio.	A. S. Cassaday.
Cawley, Charles,	Manchester,	Iowa.	E. J. Conger.
Challenger, James Truss,	New Castle,	Del.	E. Challenger.
Christ, Charles Wesley,	Selins Grove,	Pa.	J. E. Lehman.
Clark, Robert, Jr.,	Philada.,	Pa.	B. F. Sholl, M.D.
Cliffe, Albert,	Philada.,	Pa.	T. O. Nock & Co.
Clarkson, P. S.,	Beverly,	N. J.	
Camp, Harry Gearhart,	Mount Joy,	Pa.	J. J. Ottinger.
Cooley, Harry C.,	Carpenterville,	N. J.	
Cotterel, John Wesley,	Harrisburg,	Pa.	D. H. Ross, Ph.G.
Courson, Harry Stockton,	New Berry,	Pa.	W. S. Crawford, Ph.G.
Craine, W. Munroe Clarkson,	Bustleton,	Pa.	H. B. Hooper.
Creighton, Orville Sharp,	Somerton,	Ohio.	B. T. Creighton.
Curriden, George Altick,	Chambersburg,	Pa.	J. C. Altick & Co.
Dana, Jr., Oscar Fingal,	Falmouth,	Maine.	
Davis, John S. V.,	Wilmington,	Del.	H. C. Kemble, M. D.
Dean, Malcolm Graeme,	Newton,	Pa.	I. J. Grahame.
Dehler, Henry Elias,	Cleveland,	Ohio.	O. F. Lohman.

Matriculates.	*Town.*	*State.*	*Preceptor.*
DeReeves, Eugene,	Trinity,	Texas.	M. Campbell, Ph.G.
Donnell, George James,	Clifton Heights,	Pa.	G. R. Vernon, M. D.
Droelle, Frank William,	Detroit,	Mich.	E. S. Power, M.D.
Dunn, Clifford,	Chicago,	Ills.	W. R. Warner & Co.
Durell, Kinsey Embury,	Bustleton,	Pa.	J. W. Kohlerman, Ph.G.
Eagle, Edward Worrell,	New Castle,	Del.	Dr. J. T. N. Blocksom.
Eckels, Howard Samuel,	Mechanicsburg,	Pa.	W. W. Moorhead, Ph.G.M.D
Edenborn, C. Wesley Simons,	Philada.,	Pa.	J. M. Bradford, M. D.
Elden, Wm. McKee,	Bendersville,	Pa.	P. S. Brugh.
Emerson, Henry Everett,	Milford,	Pa.	C. O. Armstrong.
English, Addison Henry,	Freehold,	N. J.	J. E. Keeler.
Ennis, George A.,	Wilmington,	Del.	Kennedy & Lyman.
Evans, Charles Born,	Harrisburg,	Pa.	Jas. A. Meyers.
Falloure, Edwin Reed,	Wheeling,	W. Va.	J. B. Reynold.
Faust, John Kirk,	Reading,	Pa.	J. H. Stein.
Ferguson, James Adams,	Philada.,	Pa.	J. B. Ferguson.
Fetterrolf, Daniel Webster,	Ashland,	Pa.	S. A. Marshall.
Finfrock, Ira Elmer,	Mansfield,	Ohio.	M. V. B. Finfrock.
Fisher, Robert Wells,	Seaford,	Del.	Hopper & Forman.
Fletcher, Benjamin Kennard,	Philada.,	Pa.	A. B. Taylor.
Gabell, Pearce Cromwell,	Florence,	N. Y.	Bullock & Crenshaw.
Gallaschick, Paul Herman,	Philada.,	Pa.	H. C. Blair's Sons.
Garman, Jonas Hezekiah,	Lykens,	Pa.	Jonas Garman.
Gearhart, Harry Jacob,	Altoona,	Pa.	B. Carroll Meyer.
Geist, Richard Clement,	Medford,	N. J.	H. P. Thorn.
Georges, A. G.,	Philada.,	Pa.	H. Opperman.
Gingrich, Edward Hartley,	Lebanon,	Pa.	T. H. Potts.
Graf, Albert Fredrick,	Philada.,	Pa.	J. R. Elfreth.
Grayson, John Lincoln,	Shippensburg,	Pa.	L. S. Wolfe.
Grebe, Wm.,	Philada.,	Pa.	William Walter.
Green, Charles Wellington,	Philada.,	Pa.	J. K. Knorr.
Green, Fredrick H.,	Muscatine,	Iowa.	F. Reppert & Co.
Groom, Joseph,	Philada.,	Pa.	Hance Bros. & White
Gros, Lucian Alfred,	San Francisco.	Cal.	S. S. Bunting.
Guise, P. Nettleson,	Findlay,	Ohio.	Chas. W. Watson.
Hackett, Henry James,	Philada.,	Pa.	Dr. J. O. Eberhardt.
Hadfield, Edward John,	Dodge City,	Kansas.	Dr. T. C. McCarty.
Haglin, Henry,	Fort Smith,	Ark.	J. M. Sparks & Co.
Haley, John Joseph,	Gloucester City,	N. J.	J. A. Walmsley.
Hamill, John Fredrick,	Norristown,	Pa.	
Hanson, William Henry,	Norristown,	Pa.	Atwood Yeakle.
Hartzell, Wm. Lincoln,	Philada.,	Pa.	F. G. Howard.
Harrison, Thomas Wesley,	Philada.,	Pa.	W. B. Bicker.
Hassenplug, Wm. Finley,	Williamsburg,	Pa.	Dr. A. W. Taylor.
Hayes, W. N.,	Philada.,	Pa.	J. Frank Hayes.
Heberling, Andrew Jackson,	Danville,	Pa.	
Hellmich, Maximilian,	Philada.,	Pa.	G. H. Ochse.
Hepler, Wm. Louis,	Reading,	Pa.	M. J. Dundor.
Herrmann, Ralph Christian,	Allentown,	Pa.	Augustus Weber.
Hesske, August Rudolph,	Philada.,	Pa.	J. H. Heintzelman.
Hettinger, Howard Huyett,	Sinking Spring,	Pa.	John B. Raser.
Hibberd, Wesley Jackson,	Bridgeport,	Pa.	Geo. A. McKelway.
High, Edmund Gilbert,	Philada.,	Pa.	Hance Bros. & White.
Hildebrand, John Franklin,	York,	Pa.	F. T. Williams.
Hildreth, Chas. Benj.,	Mansfield,	Ohio.	A. J. White.
Holtzhausser, Ludwig,	Landau,	Germany.	Geo. Bille.
Hooper, Sidney Lee,	Philada.,	Pa.	Bullock & Crenshaw.
Hoover, Henry Taylor,	Philada.,	Pa.	Irving G. Melot.
Horine, Arlington Grove,	Burkettsville,	Md.	W. A. Burns, M.D.

Matriculates.	*Town.*	*State.*	*Preceptor.*
Hœrner, Kaspar,	San Antonio,	Texas.	L. Ornynski.
Hostley, Wm. Henry,	Philada.,	Pa.	A. E. Norton.
Howard, Tod,	Findlay,	Ohio.	B. Murray, M.D.
Huber, Joseph Emil,	Peoria,	Ill.	W. N. Benton.
Huntsman, Howard D.,	Richboro,	Pa.	J. V. Antill.
Jacobs, John Penn Jones,	Holidaysburg,	Pa.	E. W. Snyder.
Johnstone, Henry Havelock,	New Castle,	N. B.	E. Lee Street.
Judge, John Aloysius,	Philada.,	Pa.	Bullock & Crenshaw.
Keeler, Chas. Elmer,	Plumsteadville,	Pa.	H. C. Blair's Sons.
Keck, Frank Peter,	Allentown,	Pa.	J. Wyeth & Bro.
Kiefer, John,	Loudonville,	Ohio.	D. F. Shnell & Co.
Kelchner, Chas. Franklin,	Bethlehem,	Pa.	C. B. Lowe.
Keller, Chas. Emery,	Plymouth,	Pa.	
Keir, Wm. George,	Philada.,	Pa.	
Klapp, Elmer Augustus,	Lock Haven,	Pa.	
Kooker, Jacob Glaes,	Norristown,	Pa.	Frank. H. Poley.
Krebs, Charles,	Cleveland,	Ohio.	Wm. Krebs.
Krollpfeiffer, Fred. Wm.,	Philada.,	Pa.	C. M. Streeter.
Krull, Lewis Aylesworth,	Harrisburg,	Pa.	H. D. Dietrich.
Kuhn, Gustav Otto, Jr.,	Philada.,	Pa.	Aug. F. Gearhardt.
Lache, Oscar Julius,	Philada.,	Pa.	J. R. Stevenson.
Lackey, Richard Henry,	Philada.,	Pa.	Green & Co.
Latterner, Carl Daniel,	Galesburg,	Ills.	W. T. Baker.
Lantz, John Joseph,	Philada.,	Pa.	W. H. Lantz.
Lehman, Louis John,	Highland,	Ills.	Edwin Knoebel.
Lehr, Joseph Frank,	Lykens,	Pa.	C. D. S. Früh.
Leitch, Chas. Thomas,	Applebachville,	Pa.	C. W. Clymer & Co.
Lenhardt, Oliver Franklin,	Lancaster,	Pa.	A. C. Hubley.
Lippincott, Samuel Wesley,	Burlington,	N. J.	H. B. Weaver.
Leuschner, Paul,	Detroit,	Mich.	Richard Leuschner.
Long, John Nathan Grier,	Honeybrook,	Pa.	J. P. Remington.
Longshore, George Arthur,	Landerville,	Ohio.	C. L. Moore.
Longshore, John Ligget,	Mansfield,	Ohio.	N. Bigelow.
Lord, Miss Anna,	Odessa,	Del.	J. P. Remington.
Loughridge, Samuel Steen,	Philada.,	Pa.	J. M. Higgins.
Ludlam, Wm. Hall,	Brooklyn,	N. Y.	C. H. Gubbins.
Lyons, George,	Philada.,	Pa.	Beates & Miller.
McClanahan, John Thos.,	Galveston,	Texas.	C. E. Watson.
McCoy, Thos. Francis,	Conshohocken,	Pa.	Thos. H. Franklin.
McDavit, Henry,	Hope,	N. J.	R. N. Van Horn.
McKean, Chas. Wm.,	Salineville,	Ohio.	W. W. McGill.
McKee, Alexander,	Philada.,	Pa.	John Wyeth & Bro.
McKee, Joseph,	Bridgeton,	N. J.	H. F. Seeley.
McMechlen, Wm. Benj.,	Wheeling,	W. Va.	W. H. Williams.
McNeil, Robt. Carson,	Philada.,	Pa.	Robt. McNeil, Jr.
Maris, Robt. Wood,	Philada.,	Pa.	S. C. Webster.
Martin, Chas. Henry,	Covington,	Ohio.	C. J. Biddle.
Marquardt, Jesse Claude,	Tiffin,	Ohio.	Z. T. Marquardt.
Mauger, Henry Snider,	Douglassville,	Pa.	H. C. Watt.
May, John Aj.,	Manchester,	Iowa.	C. C. Spannagel.
Mayer, Albert Henry,	Reading,	Pa.	H. H. Kneedler.
Mayo, Caswell Armstrong,	Columbus,	Miss.	J. P. Bolton.
Mell, Samuel Stansberry,	Harrisburg,	Pa.	James T. Shinn.
Mickey, Harry Edgar,	Fostoria,	Ohio.	Chas. Hays.
Miller, James A.,	Rohrerstown,	Pa.	H. B. Cochran.
Miller, Chas. Joseph,	New York City,	N. Y.	Dr. Chas. Bauer.
Moffett, Thos. James,	Edinboro,	Ind.	L. K. Slifer, M. D.
Moller, John Daniel,	Philada.,	Pa.	Dr. Lamparter.
Moyer, John Oscar,	Auburn,	Pa.	B. T. Coulter, M. D.

Matriculates.	*Town.*	*State.*	*Preceptor.*
Moyer, Wm. Erwin,	Allentown,	Pa.	Saml. Gerhart.
Muir, John Ray,	Lock Haven,	Pa.	Wm. A. Rumsey.
Mulford, Harry Kendall,	Bridgeton,	N. J.	L. E. Sayre.
Murray, Wm. Robt.,	Harrisburg,	Pa.	A. W. Nunemacher.
Nardyz, Emma Bour,	Philada.,	Pa.	Susan Hayhurst, M.D.
Neiman, Levi Allen,	York,	Pa.	S. H. Shingle.
Nelson, Wm. Heisley,	Philada.,	Pa.	Smith, Kline & Co.
Neumeister, Otto Chester,	Sheboygan,	Wis.	J. A. Heintzelman.
Nolting, Geo. Wm. Fred,	Seymour,	Ind.	J. H. Andrews.
Ousey, Samuel Byron,	Clifton Heights,	Pa.	Barker, Moore & Mein.
Outhwaite, Chas. Wm.,	Dundas,	Canada.	Wiley & Harris.
Outten, Elmer,	Philada.,	Pa.	S. D. Marshall.
Partee, Wm. Arky,	Nashville,	Tenn.	Demoville & Co.
Painter, Howard Thatcher,	Darby,	Pa.	Harland Cloud.
Patton, John George,	Youngstown,	Ohio.	Dr. M. West.
Pennock, Edw.,	Oxford,	Pa.	Geo. Cook.
Peters, David Augustus,	Harrisburg,	Pa.	J. White Murrow.
Pinchback, Pinckney Napoleon,	New Orleans,	La.	Wiley & Harris.
Platt, Edwin Montague,	Chambersburg,	Pa.	H. C. Blair's Son.
Pleibel, Adolph Wm.,	Philada.,	Pa.	Dr. Fred. Pleibel.
Pollock, Jr., Robt. Blair,	Philada.,	Pa.	J. R. Elfreth.
Porter, Wm. David,	Mahanoy City,	Pa.	C. D. Früh.
Potts, John Franklin,	Titusville,	Pa.	T. W. Reuting.
Prochaska, Otto,	Cleveland,	Ohio.	C. L. Heckler.
Ranftle, Oscar,	Long Island,	N. Y.	Wm. E. Lee.
Raynor, Howard Lincoln,	Norristown,	Pa.	R. Shoemaker & Co.
Rea, John,	Chester,	Pa.	W. H. Farley.
Read, Clinton Hubert,	Williamstown,	N. J.	Geo. Holland.
Redner, Thaddeus Roland,	Rolandsville,	Pa.	W. C. Ebaugh, M.D.
Reese, Birch Taylor,	Philada.,	Pa.	Wiley & Harris.
Reeve, Walter Sharpless,	Moorestown,	N. J.	
Rehfus, Chas.,	Eaton,	Ohio.	A. P. Blomer.
Rhein, Jno. Henry,	Philada.,	Pa.	H. L. Stiles.
Riedenaur, Fred. Philip,	Philada.,	Pa.	Bullock & Crenshaw.
Reindoller, Chas. Wesley,	Philada.,	Pa.	Chas. G. Frowert.
Ringler, George Parsons,	Bloomsburg,	Pa.	Sam'l. P. Wright.
Ritter, Norman Gruver,	Philada.,	Pa.	Wm. L. Cliffe.
Rixstine, Livingston Everett,	Phœnixville,	Pa.	R. G. Stevenson.
Ross, John Patterson,	Russellville,	Pa.	D. W. Hutchison.
Rottner, Chas. Selner,	Philada.,	Pa.	Pauline Rottner.
Rowe, Wm. Clymer,	Reading,	Pa.	Henry M. Muhlenburg
Ruoff, Wm.,	Philada.,	Pa.	Dan'l. Follmer.
Sample, Nathaniel Welchard,	Philada.,	Pa.	Z. James Belts.
Saurer, Wm. Henry,	Philada.,	Pa.	Chris Petzelt.
Seary, Wm. Notson,	Philada.,	Pa.	Wm. Notson.
Seibert, Edward Grant,	Chambersburg,	Pa.	Clark R. Craig.
Seiffert, Otto,	Davenport,	Iowa.	J. B. Mason.
Seither, Chas. Albert,	Philada.,	Pa.	Bullock & Crenshaw.
Scattergood, Chas. Rinear,	Mt. Holly,	N. J.	Craig Moffett.
Schmidt, Harry Ellsworth,	Philada.,	Pa.	L. C. Funk.
Schofield, Thos. Le Blanc,	Philada.,	Pa.	Hance Bros. & White.
Scott, Wm. James,	Wilkesbarre,	Pa.	Dr. L. W. Hildebrand.
Shaak, Franklin Philip,	Philada,	Pa.	H. H. Ross, Ph. G.
Shaw, Henry Burfield,	Philada.,	Pa.	W. G. Toplis.
Shoemaker, Ellery Best,	Lock Haven,	Pa.	James G. Wells.
Shrader, Fred Rennard,	Chillicothe,	Ohio.	W. H. Howson.
Simmons, Rob't. Edwin,	Elizabeth City,	N. C.	H. C. Manlove.
Slaughter, John Virgil,	Rio Grande,	N. J.	C. L. Ross.
Smith, Phairis Edwin,	Saegertown,	Pa.	H. Duffield, M. D.

Matriculates.	*Town.*	*State.*	*Preceptor.*
Smith, Walter Adam,	Philada.,	Pa.	J. H. Bohmer.
Smith, Walter Valentine,	Philada.,	Pa.	V. H. Smith & Co.
Smith, Willard Eugene,	Wilmington,	Del.	Smith Cooper.
Smyser, John Rieman,	York,	Pa.	W. H. Llewellyn.
Snyder, Wm. Lincoln,	Troy,	Ohio.	
Souder, Geo. Reed,	Atlantic City,	N. J.	Souder & Bro.
Steltzer, Nathan Joseph,	Brooklyn,	N. Y.	H. P. John.
Steinmann, Gus.,	Monroe,	Wis.	W. P. Stearns.
Stevenson, John Stuart,	Philada.,	Pa.	Thos. H. Potts.
Stewart, Aaron Walter,	Newtown,	Pa.	Jos. Crawford.
Stewart, Henry Clifton,	Wheeling,	Va.	Henry Mueller.
Strasser, Jr., John Jacob,	Trenton.	N. J.	F. R. Jummel.
Streeper, Frank Park,	Chestnut Hill,	Pa.	T. L. Buckman.
Strunk, Lewis Curtin,	Quakertown,	Pa.	W. M. Brown.
Sutton, Wm. Henry,	Dublin, Ireland.		G. W. Shingle.
Suydam, John Derr,	Philada.,	Pa.	T. E. Conard, M. D.
Tatem, Henry Randolph,	Collingswood,	N. J.	Isaac W. Lutz.
Taylor, Bennett Lewis,	Janesville,	Ohio.	W. H. Graham.
Taylor, Gove Saulsbury,	Smyrna,	Del.	Wm. Spencer & Co.
Tittle, William Grant,	Harrisburg,	Pa.	Dr. J. H. B. Emick.
Todd, James Charles,	Roxboro,	Pa.	W. C. Todd. M. D.
Trauck, Chas. Cadrick,	Tinicum,	Pa.	Carpenter, Henzey & Co
Vandegrift, Wm. Harry Flitcraft,	Philada.,	Pa.	Wm. Reisert.
Van Scoter, Jay Chester,	Jamestown,	N. Y.	Frank W. Palmeter.
Wagner, Geo. Lewis,	Allentown,	Pa.	D. S. Jones.
Walton, Nathan P.,	Kennet Square,	Pa.	Thos. Hunter, M. D.
Warren, Nathan Chew,	Upland,	Pa.	C. L. Lashell.
Watson, Maurice,	Bristol,	Pa.	Serrill Douglass.
Weber, Wm.,	Philada.,	Pa.	August Weber.
Weckler, Gustavus Adolphus,	Oakland,	Wis.	A. Robbins.
Weidmayer, Fred Franklin,	Leetonia,	Ohio.	J. E. Duff.
Welliver, Robt. Fruit,	Bloomsburg,	Pa.	F. P. Albright.
Wenner, Geo. Victor,	Allentown,	Pa.	N. Ranck.
Werner, Reinhold Chas.,	Milwaukee,	Wis.	H. H. Hackendohl.
Wetteroth, Henry,	Bordentown,	N. J.	B. Hankins.
Weyand, Wm. Jacob,	Philada.,	Pa.	Stansbury & Bibby.
White, Edw. Riall,	Saulsbury,	Md.	Bullock & Crenshaw.
Whitney. Heston,	Glassboro,	N. J.	James G. Wells.
Wilgus, William Alcott,	Philada.,	Pa.	J. F. Wilgus.
Wilkinson, Geo. Henry,	Camden,	N. J.	J. G. Murray.
Winslow, Colburne Thue.,	Benezette,	Pa.	E. W. Sharp.
Wishart, Fred. Gray,	Philada.,	Pa.	F. E. Harrison.
Wissler, Benj. A.,	Millersville,	Pa.	Drs. Keeler & Rauck.
Wolfersberger, Geo. Wash.,	Campbellstown,	Pa.	A.W. Peck.
Wrigley, John Thomas,	Chester,	Pa.	James Spead.
Wyeth, Maxwell,	Philada.,	Pa.	John Wyeth & Bro.
Young, Robt. Taylor,	Philada.,	Pa.	A. B. Wenrich.
Young, Wayland Philips,	Atglen,	Pa.	Dr. O. Higgate.
Zeller, Albert Theodore,	Rochester,	N. Y.	R. Opperman, M. D.